Electrical Review

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Use of Pulverized Coal in Steam Power Plants

Method Employed in Handling and Preparing Fuel for Delivery to Furnace—Pipe Line Used to Convey Pulverized Coal 1000 Ft. —Some Test Results With Anthracite Silt and Bituminous Coal

By H. A. REICHENBACH

Fuller Engineering Co., Allentown, Pa.

Pulverized coal as a boiler fuel has made such rapid strides in various industries where the cost of power is a vital factor in the expense of producing the finished product that anyone concerned with economical power production cannot ignore its advantages.

The management of the Allentown Portland Cement Co., whose plant is located at Evansville, Pa., have been fully appreciative of the savings made possible when using an otherwise worthless coal, such as anthracite culm in pulverized form, in place of the better and more expensive grades of bituminous coals fired on stokers for power production. Until quite recently the general arrangement of the plant was not favorable to the application of pulverized coal to the boilers as the coal milling plant is located approximately 1000 ft. from the boiler house and an installation would have necessitated the use of a long and unwieldy screw and elevator system with its attendant disadvantages in construction and operation. With the development of the Fuller-Kinyon pulverized material conveying system the objection from this quarter was removed and one

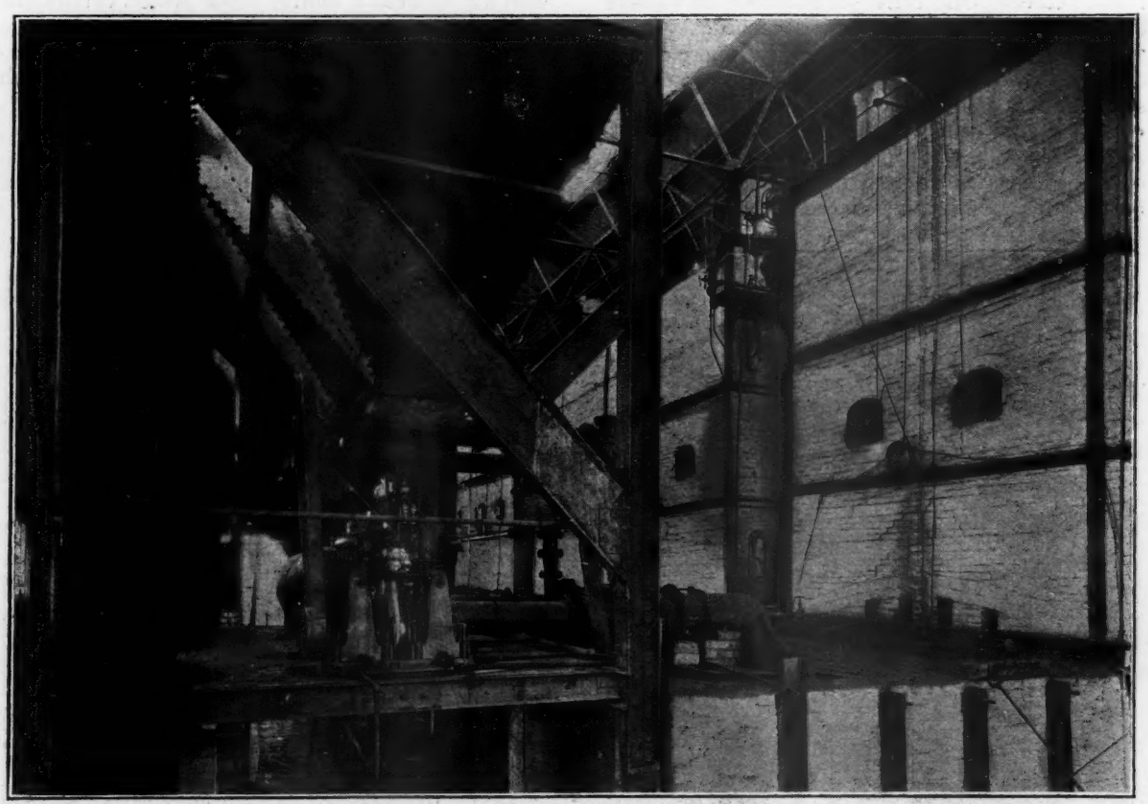


Fig. 1.—View Through Boiler House, Allentown Portland Cement Co., Showing Pulverized Coal Fired Boiler in Foreground, Vertical Burners for Low Volatile Coals, Fuller Screen Feeders, Feeder Drive and Turbine Fans.

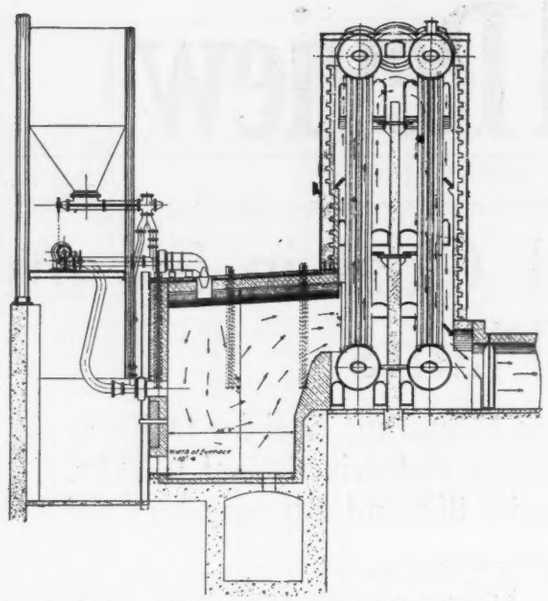


Fig. 2.—Sectional View Through Rust Boiler, Allentown Portland Cement Co., Evansville, Pa.

404-hp. Rust boiler was equipped for firing pulverized coal and put into service during April, 1920.

In the application of pulverized fuel the green coal requires a certain amount of preparation and it is pertinent here to describe in a general way the process through which the fuel passes before being in the proper form for burning.

The coal is delivered to the coal house in cars which discharge directly into a hopper and on to rolls where all large sizes are crushed, thence carried by elevator and conveyor to a covered storage bin of approximately 2000 tons capacity. From storage the fuel is fed by gravity into an elevator discharging over a magnetic separator into bins serving two 4½ by 30-ft. Fuller indirect fired rotary dryers where moisture is driven off to about 1% or less of that in extraneous or uncombined form. The dried coal is then delivered by elevator to mill bins placed directly over two 42-in. and one 57-in. Fuller mills, depending on the service for which the fuel is intended and the quantity required. The 42-in. mills are used mostly for bituminous coal intended for kiln use, while the 57-in. mill pulverizes all the lower grades of fuel such as anthracite culm, coke, coke braise, bone coal, etc., intended for boiler fuel, which on account of low volatile contents are not of proper quality for cement burning in rotary kilns.

Equipment for Conveying and Feeding Fuel Into Furnace.

The pulverized fuel is delivered by gravity directly from the pulverizer to the feed hopper of a Fuller-Kinyon pulverized material pump which fluidizes the coal and imparts motion to the mass so that the mixture is carried through a 3-in. standard pipe line to the boiler hoppers, a total distance of 1000 ft. with a rise in elevation of 45 ft.

This system of conveyance is such a radical change from anything heretofore accomplished and of such recent development that a general description is opportune. The essential features consist of a specially designed worm or screw revolving in a barrel. The worm is mounted on a shaft which extends through packing glands in each end of the working chamber and is supported by two external or outboard ring-oil bearings, thus eliminating the possibility of the coal coming in contact with the bearing metal. The coal is fed in at one end of the pump and is carried by the screw to the aerating chamber on the discharge end where the compact mass is liquified by a very small amount of air injected at moderate pressure. The combined action of the worm and air induces a motive force which carries the fuel to its destination through a supply pipe making a number of bends sidewise, directly upward and downward and for part of its length buried underground while the remainder is carried on overhead supports. The line terminates at the boiler bins, into which the fuel is discharged through a distributing valve installed on the main line just ahead of the bins.

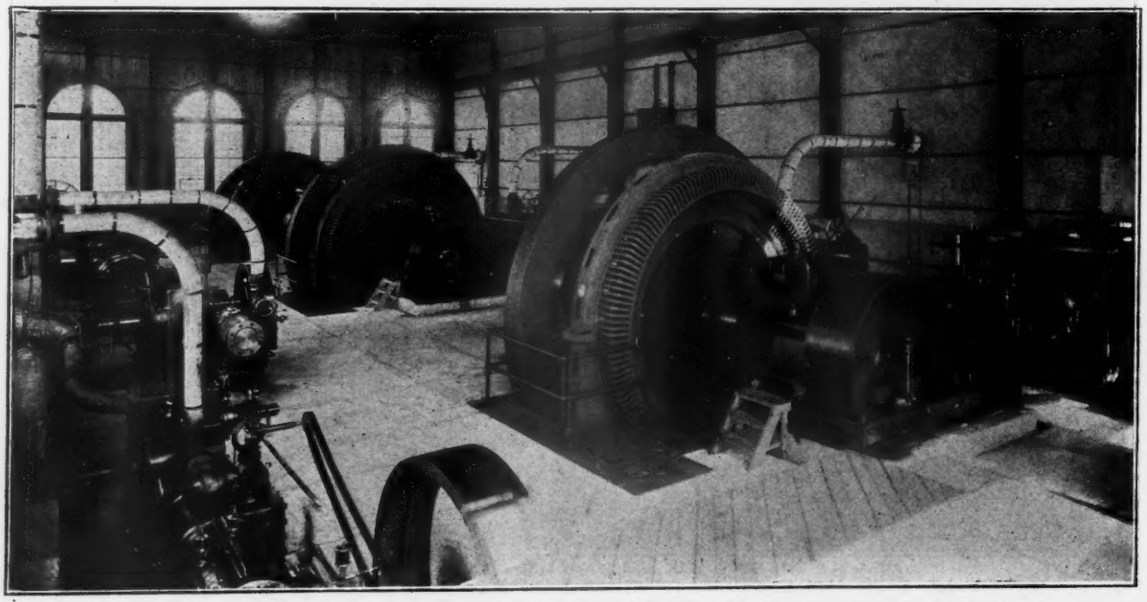


Fig. 3.—Power House of Allentown Portland Cement Co., Evansville, Pa.

The boiler bins are divided into two compartments. Fuel is discharged direct from the line into one of the hoppers, while a small secondary weighing bin mounted on a platform scale is placed just above the second hopper into which coal is discharged, thus enabling an exact weight to be delivered for economy or efficiency tests. The capacity of the weighing bin is about 500 lbs. It discharges by gravity through a plug valve into one of the main compartments.

Two 5-in. screw feeders take the fuel, descending by gravity from the bins and deliver it to a vertical pipe through which it falls until it is caught by a stream of low pressure air supplied by a turbine fan and delivered to the burner for combustion.

The boiler is a 404-hp. Rust type without superheater and economizer, connected through a flue to an individual natural draft stack. It is equipped with both a vertical and horizontal flare type Fuller burner. The former for anthracite coal or any fuel low in volatile contents and the latter for bituminous coals. Appropriate air inlets with damper regulators are placed in the sides and front of the combustion chamber so that proper temperatures and air supply can be maintained. Clean out doors are placed in the bottom front of the furnace for removing dust and ash. This accumulation is discharged at regular intervals through two vertical openings in the bottom of the firebox to cars in the ash tunnel serving the pulverized coal and stoker fired boilers.

The feed water lines are so arranged that the boiler can be fed through the battery supply line, or in testing this line can be sealed and all water measured in a calibrated tank and passed to the boiler through an individual line.

Firing with the bituminous coal is started by placing a piece of oil-saturated waste in front of the burner, turning on the air and coal supply and regulating the damper so that there is just enough draft to draw the gases through the boiler. Steam can be raised to line pressure in about 30 min. after starting up from cold.

The procedure for anthracite coal is a little different. On account of the low volatility this coal does not flash readily and the temperature of the furnace must be raised to the point where it will support combustion by some auxiliary means such as an oil burner or wood fire kindled on the hearth. After combustion is self-supporting the same flexibility and positiveness of operation is assured with all grades of fuel, the amount consumed per unit of time depending on design and size of furnace.

The small accumulation of ash in the furnace is cleaned out once every 12 hrs., although this is not an absolute necessity and at times the ash has been allowed to accumulate for 2 or 3 weeks without any decrease in operating economy or efficiency.

The tubes are blown off every 6 hrs. with mechanical soot blowers and the bridge wall is blown off occasionally with a hand steam lance to prevent deposits which might obstruct the free flow of gases.

The boiler is equipped with the necessary refinements with which to check operating conditions, including a steam flow meter, carbon dioxide recorder, recording pyrometer, having thermo-couple connections in the stack and in the combustion chamber, draft gages indicating suction in stack and combustion chamber and pressure gages to govern control of the fan air pressure.

Fig. 4.—Pulverized Coal Fired Boiler, Allentown Portland Cement Co.

Actual Tests Show Efficiency and Economy to Be Obtained.

Since the installation has been completed a number of tests have been made on different grades of fuel including bituminous, anthracite silt, coke braise and Rhode Island anthracite. The results obtained in each instance fully demonstrated the economy obtained.

The accompanying tabulation of average data obtained in operation is significant, especially since no attempt was made to dress up the boiler for the occasion, and these results are obtained in regular routine running.

The results in column No. 1 were obtained by disinterested engineers representing the New York Edison Co., Brooklyn Edison Co. and Stone & Webster Corporation who were invited to take charge of the test on this boiler, and the following is condensed from the report of these engineers:

> The coal was then weighed on platform scales and dumped into the feeding hopper in front of the boiler. The test was started with empty feed hoppers and was ended with one feed hopper empty and the other one practically empty.
>
> The water was measured in a calibrated tank holding approximately 2000 lbs. The tank was equipped with an overflow pipe and it was filled each time until it overflowed vigorously, and then allowed to stop overflowing before the discharge valve was opened. The conents of the tank were checked by weighing on platform scales, the temperature on each tank of water being taken and appropriate corrections applied.
>
> The water level was carried at all times at about one-third of the glass by means of a feed regulator and the reading of the CO_2 recorder determined the CO_2.
>
> In my estimation this test if it had been operated under an efficient type boiler would have shown an efficiency of between 80 and 81%.

The Rust boiler has been in service for a period

of 12 yrs. and although the baffles were placed in good condition, the fact that this boiler is of the two-pass type and also at this time no provision had as yet been made for blowing the tubes, the flue gases had a tendency to increase in temperature when operated much above rating.

TABULATION OF AVERAGE DATA OBTAINED IN OPERATION.

	1.	2.
1. Type of boiler	Rust	Rust
2. Rated hp.	404	404
3. Heating surface, sq. ft.	4,040	4,040
4. Cubic contents of furnace, cu. ft.	2,040	2,040
5. Kind of coal	Bituminous	Anthracite silt
6. Draft	Natural	Natural
7. Type of burner	Fuller horizonal	Fuller vertical
8. Approximate analysis of coal—		
Moisture, %	1.0	.98
Volatile matter, %	37.1	7.89
Fixed carbon, %	50.7	68.53
Ash, %	11.2	22.6
9. B.t.u. per pound coal as fired	13,280	11,654
10. B.t.u. per pound coal dried	13,393	11,765
11. B.t.u. per pound combustible	15,100	15,249
12. Carbon dioxide in flue gas, %	12.9	10.2
13. Average steam pressure lbs. gage	142.1	134.0
14. Feed water temperature to boiler deg. F.	110	62
15. Boiler room temperature deg. F.	85	52
16. Furnace temperature deg. F.	2220	.....
17 First pass temperature deg. F.	.....	839
18. Flue temperature deg. F.	621	519
19. Factor of evaporation	1.150	1.198
HOURLY QUANTITIES OF WATER AND COAL.		
20. Quality of steam (assumed)	.98	.98
21. Actual water evaporated, lbs.	13,486	17,621
22. Equivalent water per hour. lbs.	15,510	21,110
23. Coal as fired, lbs.	1,468	2,346
24. Dried coal per hour	1,453	2,323
25. Combustible per hour	1,299	1792.8
26. Combustible per hour per cu. ft. of combustion chamber	.6367	.8964
EVAPORATION:		
27. Equivalent evaporation per lb. coal fired	10.56	8.99
28. Equivalent evaporation per lb. dry coal fired	10.67	9.08
29. Equivalent evaporation per lb. combustible	12.04	11.77
30. Equivalent evaporation per sq. ft. of heating surface per hour	3.84	5.22
31. Furnace draft, ins. of water	.11	.095
32. Flue draft, ins. of water	.37	.49
33. Average boiler hp. developed	450	611.8
34. Percentage rating	111.2	151.4
35. Combined efficiency, %	77.3	74.9

It is considered that the efficiencies of 77.3 and 74.9% as stated above in connection with ratings of 111.2 and 151.4% is most excellent when the type, age and condition of the boiler are considered.

The capacity of the plant is 2600 bbls. of cement per day requiring 1200 boiler hp., which is equivalent to 28,800 boiler hp-hrs. or 11.08 boiler hp-hrs. per barrel of cement produced.

The cost of equipping four boilers for pulverized coal firing would be approximately $34,000 plus $6000 for the Fuller-Kinyon conveying system would make a necessary total investment of $40,000.

The saving effective by using pulverized bituminous or pulverized anthracite silt versus stoker practice would be $23,768 per year in the former and $63,336 per year in the latter case which is equivalent to a yearly return on the investment of 59.4% for pulverized bituminous and 158.3% for anthracite silt firing over stoker operation.

TABULATION OF COAL CONSUMPTION AND COSTS.

Bituminous coal on stokers, 4.3 lbs. per b. hp. at approximately 62% efficiency.
Pulverized bituminous coal, 3.27 lbs. per b. hp. at approximately 77.3% efficiency.
Pulverized anthracite silt, 3.83 lbs. per b. hp. at approximately 74.9% efficiency.

COST OF FUEL DELIVERED TO THE FURNACE.

Bituminous coal on stokers, per ton	$6.35
Bituminous coal pulverized, per ton	6.65
Anthracite silt pulverized, per ton	3.30

COST OF FUEL DELIVERED AT FURNACE, PER BBL. OF CEMENT.

Bituminous coal on stokers	$0.151
Bituminous coal pulverized	0.1204
Anthracite silt pulverized	0.0698

COST OF FUEL DELIVERED AT FURNACE PER YEAR OF 300 DAYS' OPERATION.

Bituminous coal on stokers	$117,780
Bituminous coal pulverized	93,912
Anthracite silt pulverized	54,444

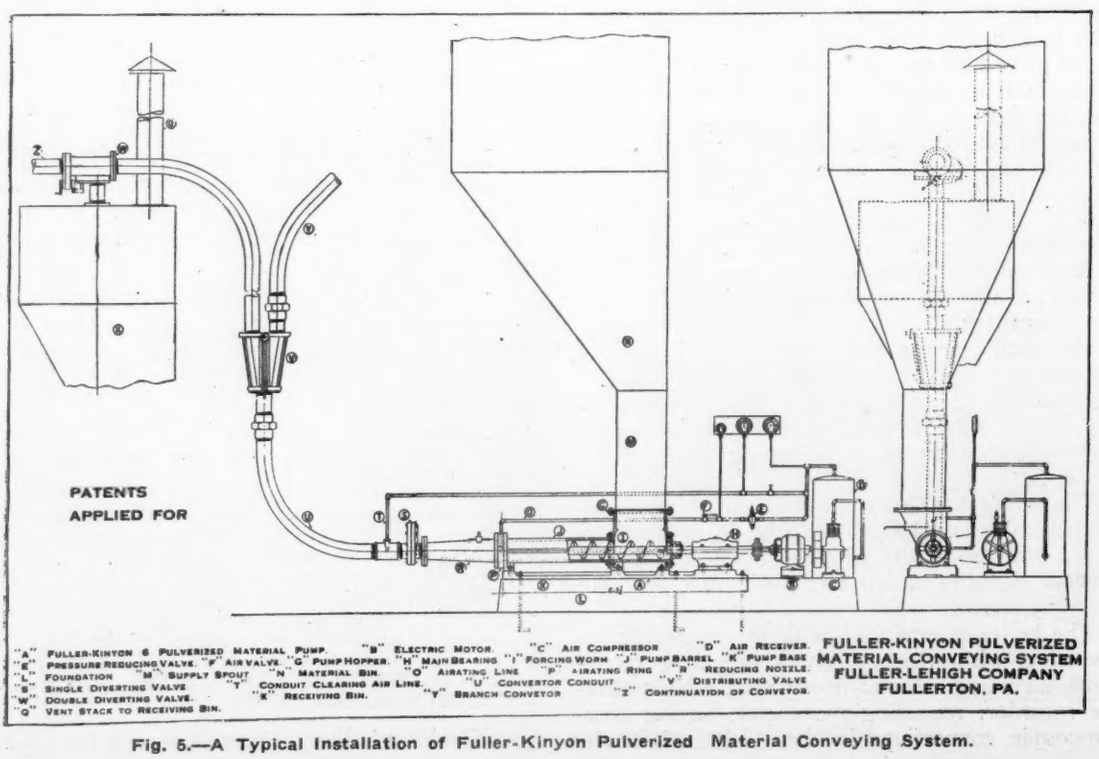
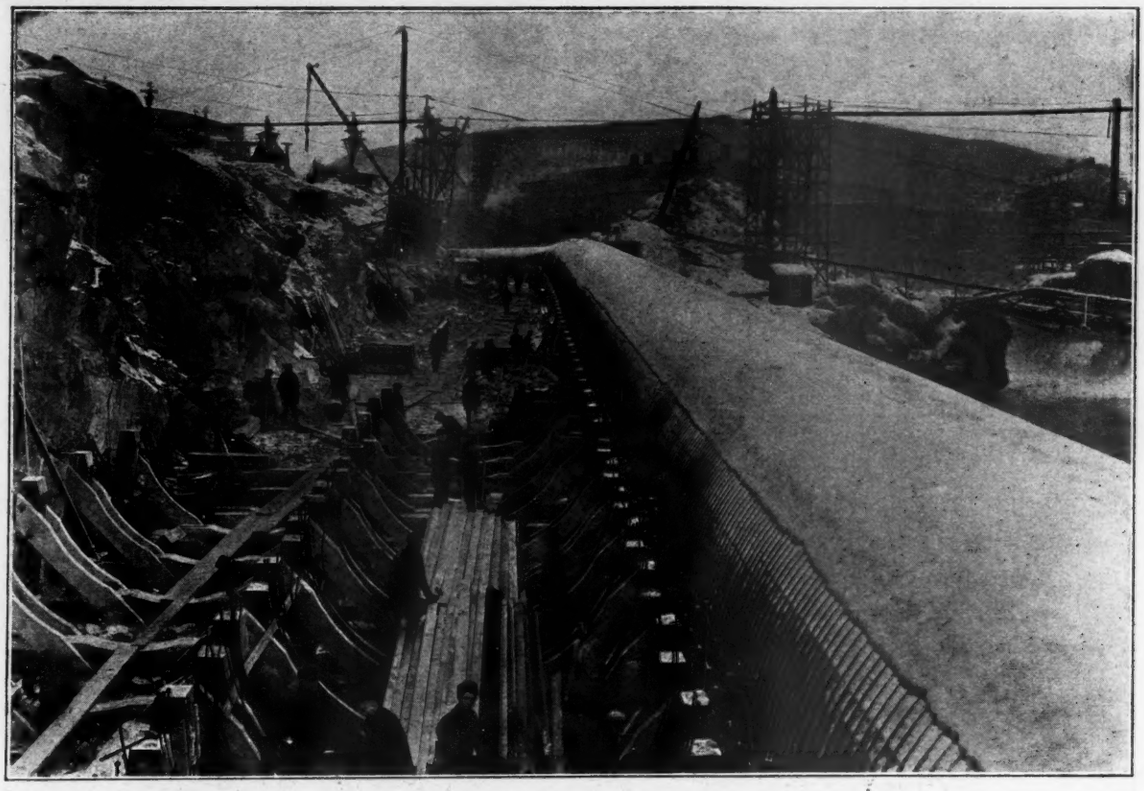

PATENTS
APPLIED FOR
"A" FULLER-KINYON 6 PULVERIZED MATERIAL PUMP. "B" ELECTRIC MOTOR. "C" AIR COMPRESSOR "D" AIR RECEIVER.
"E" PRESSURE REDUCING VALVE. "F" AIR VALVE. "G" PUMP HOPPER. "H" MAIN BEARING "I" FORCING WORM "J" PUMP BARREL "K" PUMP BASE
"L" FOUNDATION "M" SUPPLY SPOUT "N" MATERIAL BIN. "O" AIRATING LINE "P" AIRATING RING "R" REDUCING NOZZLE.
"S" SINGLE DIVERTING VALVE "T" CONDUIT CLEARING AIR LINE. "U" CONVEYOR CONDUIT "V" DISTRIBUTING VALVE
"W" DOUBLE DIVERTING VALVE. "X" RECEIVING BIN. "Y" BRANCH CONVEYOR "Z" CONTINUATION OF CONVEYOR.
"Q" VENT STACK TO RECEIVING BIN.
FULLER-KINYON PULVERIZED MATERIAL CONVEYING SYSTEM
FULLER-LEHIGH COMPANY
FULLERTON, PA.

Fig. 5.—A Typical Installation of Fuller-Kinyon Pulverized Material Conveying System.



Progress of Constructing Triple Wood Stave Pipe Line from Dam on Androscoggin River to Power Plant by the Brown Co., of Berlin, N. H.

Wood Pipe Lines in New England Hydroelectric Development

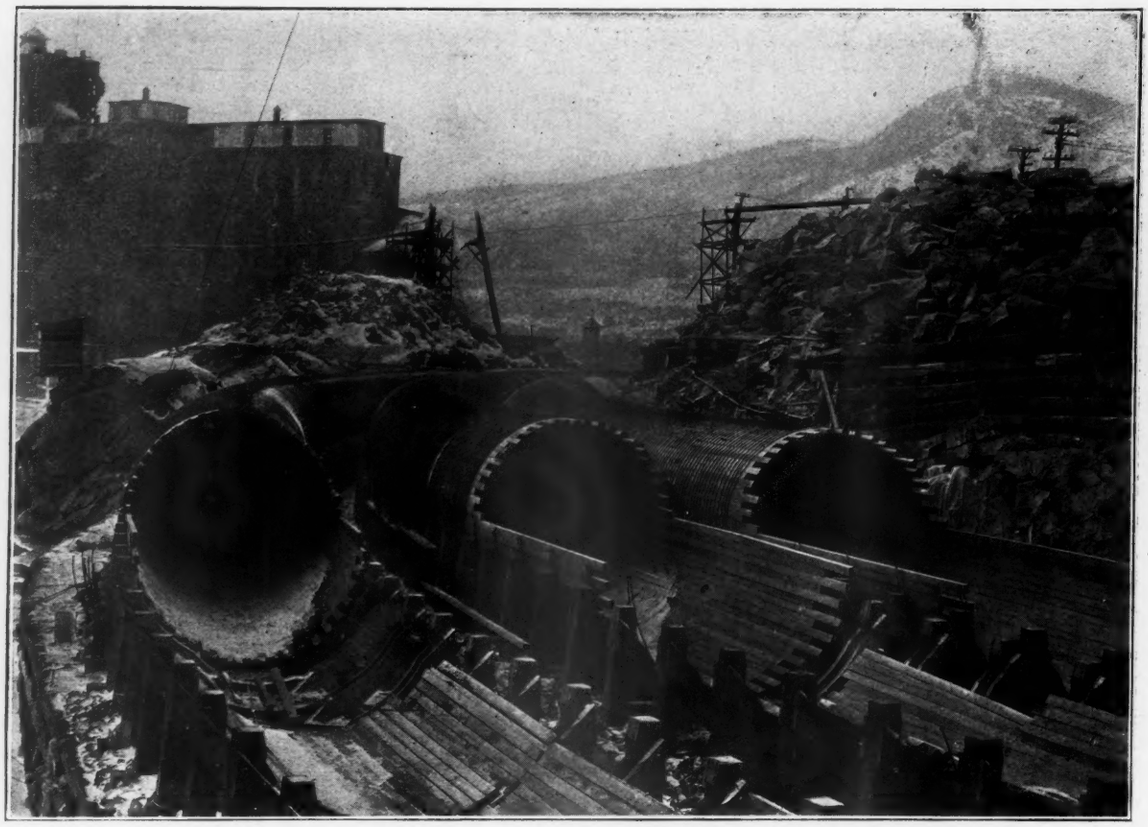
Fir Wood Staves From Pacific Coast Utilized for Conduit Construction in East—Entire Volume of Androscoggin River Sent Through Three 13-Ft. Pipes — Some Illustrations of Installation

One of the outstanding features of several Eastern power projects is the utilization of fir-wood staves from the Pacific coast in the construction of pressure pipe lines of large diameter. Attention may be called to a most interesting installation made for the Brown Co. of Berlin, N. H., whereby the entire volume of the Androscoggin river, about 2400 sec.-ft., was diverted into three wood-stave pipe lines, each 13 ft. dia. and 3900 ft. long. These are parallel lines leading to three hydroelectric units of a capacity to produce 15,000 hp. in electrical energy. The maximum pressure on the pipe lines is that exerted by a 54-ft. head. The three Allis-Chalmers hydraulic turbines installed here operate under a static head of 65 ft.

Laying the three pipe lines along the river required considerable rock excavating, and for some distance the pipe next to the river had to be supported by cribbing and rock fill, as is shown in one of the illustrations. The sharpest curves on the three parallel lines are on a radius of 550 ft. The three lines are supported by wooden cradles spaced on 7-ft. centers. The material of which the cradles were made was subjected to the kyanizing wood preservative treatment. The wooden staves, of Douglas fir, were 3½ ins. thick for the three lines, and the pipes pass through the dam and were concreted into the dam structure. The pipe lines were installed by the Continental Pipe Manufacturing Co., Seattle, Wash., under supervision of R. B. Fulton, construction engineer, acting under direction of H. D. Coale, chief engineer of the company.

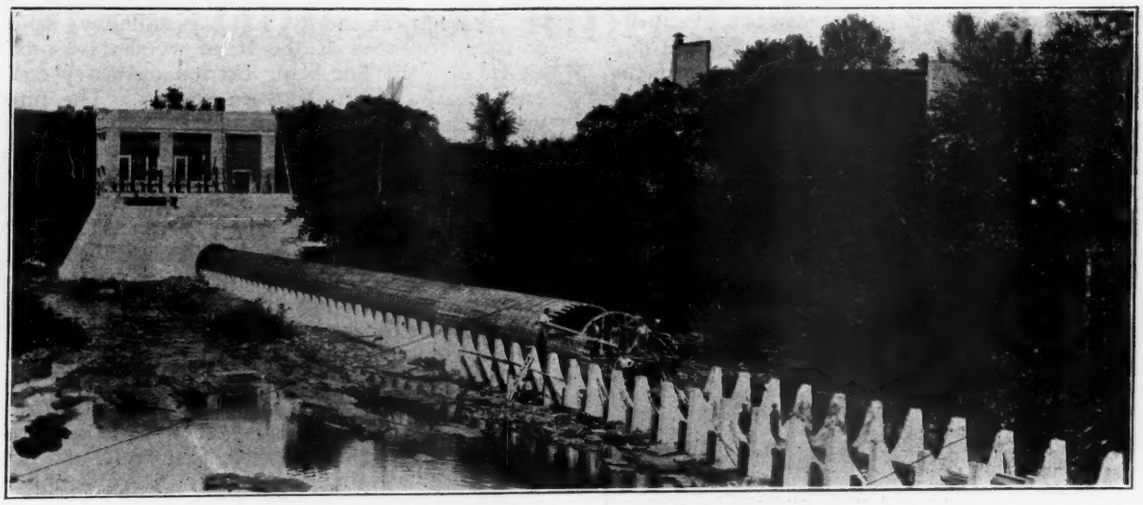
The Brown Co. is a large consumer of power in the operation of paper mills, a sulphite plant and lumber mills.

Another power project, completed and placed in service within the last year, was that of the Grafton County Electric Light & Power Co., at White River Junction, Vermont. In this enterprise 55 sec.-ft. of water is diverted from a tributary of the White river, and carried to a 1000-kv-a. generating unit by means of a line of wood-stave pipe, 3900 ft. long and 80 ins. dia. The maximum static head on the pipe line is 70 ft. The hydroelectric unit consists of an S. Morgan Smith vertical turbine and a General Electric generator. One of the problems of the pipe-line construction was the method of cross-

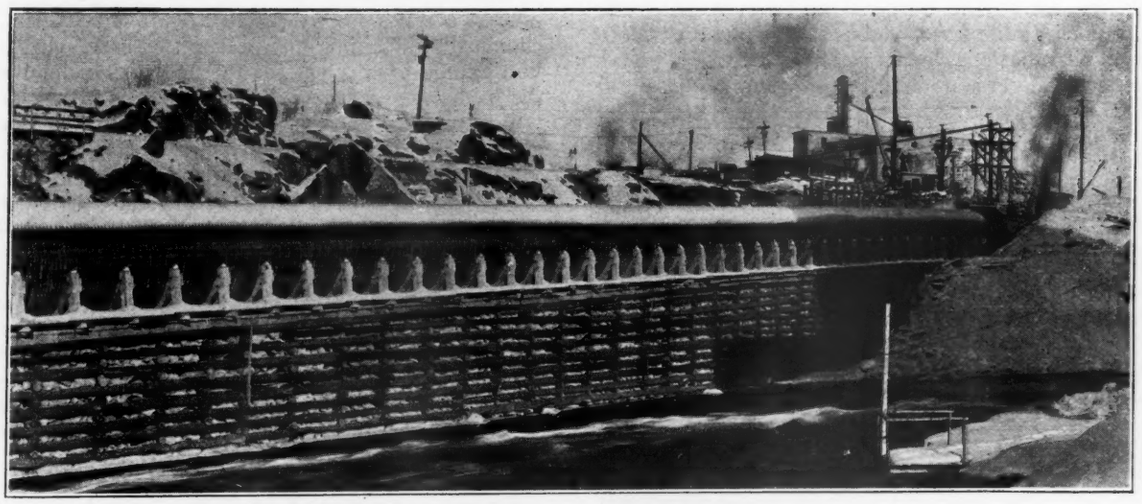


View of Triple Wood Stave Pipe Line of the Brown Co. Under Construction.

A Completed Section of the Triple Wood Stave Pipe Line of the Brown Co.



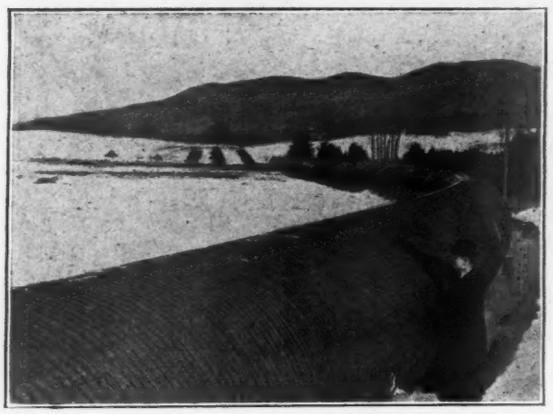
Constructing Wood Stave Line and Forebay, Plant of Nashua River Paper Co.



Cribbing and Rock Fill on the Triple Pipe Line on the Androscoggin River.

Dam of Hydroelectric Corp.—An Earth Fill Dam With a Concrete Core Wall.

ing the river. The plan adopted was temporarily to divert the flow by means of a cofferdam and lay the pipe in a trench across the bed of the stream. Another feature of the line was the construction of a wood-stave surge tank, 66 ft. high



Douglas Fir, 78-in. Line of Vermont Hydroelectric Corp., Built by Continental Pipe Mfg. Co., Seattle.

and 18-ft. dia., at a point above the penstock. Water enters the surge tank from a concrete chamber at the base, and passes from the wood pipe into that chamber through a T-section. The concrete diversion dam is the second one built at this site, the first having been washed out. The outlet at the dam is through a steel nipple embedded in the concrete, and this connects with the wood pipe at the down stream face of the dam.

The plant of the Vermont Hydroelectric Corp., built in the fall of 1920, involved the construction of an earth-fill dam around a concrete core, the laying of 7600 ft. of 78-in. fir wood pipe, and the installation of two hydroelectric units of the combined capacity of 4000 hp. The accompanying illustration of the dam shows a spillway of 100-ft. length, and the concrete structure pertaining

Douglas Fir, 80-in. Line Built for Grafton County Light & Power Co., White River Junction, Vermont.

thereto. The pipe line carries 200 sec.-ft., under the maximum head of 210 ft. The section of the greater pressure has a 2½-in. thickness of shell. The line is supported by concrete cradles spaced on 8-ft. centers. The power plant is situated about 4 miles northwest of Rutland.

Conspicuous among the wood-stave pipe lines of large diameter in the New England states is that of the Nashua River Paper Co. at East Pepperell, Mass., for the development of 2000 hp. of electrical energy. This installation, made in 1920, consisted of 580 ft. of wood-stave pipe, 13 ft. dia., the line being carried on heavy concrete cradles, 8 ft. between centers. The pipe was made of Douglas fir staves 3½ ins. thick. It passes through the concrete dam and extends to a concrete forebay at the powerhouse in which the hydraulic turbine is operated under a 25-ft. head. In the illustrations herewith the concrete cradle construction, pipe line and forebay are shown.

The wooden staves for all the pipe lines above referred to were sawed, planed and milled to the requisite dimensions and radial curves in the Pacific coast plants of the Continental Pipe Mfg. Co., and shipped ready for assembling on the ground. As may be observed, the supporting cradles for large diameter wood pipe lines require a considerable quantity of concrete, or when carried on wooden cradles heavy construction is necessary.

PRINCETON UNIVERSITY ENLARGES ENGINEERING SCHOOL.

The trustees of Princeton University have planned to enlarge its School of Engineering, giving courses in civil, electrical, mechanical, chemical and mining engineering. These courses will extend over 4 yrs., at the end of which time the bachelor's degree will be given. A fifth year will be required for an engineering degree. The plan of the school is one which will not compete with those of engineering schools giving a 4-yr. course, the intention being to make each of the courses mentioned such that the student will secure sufficient engineering training in 4 yrs. to become an assistant to an engineer, and so be self-supporting, and in addition receive a thorough grounding in physics, chemistry, mathematics, languages, literature, philosophy, economics and sociology to give him a broad outlook on every-day problems. The endeavor will be to make an engineer rather than a specialist. The fifth year is to be devoted primarily to engineering subjects, including certain courses in engineering economics and possibly a limited amount of research.

Prof. Arthur M. Greene, Jr., of the Rensselaer Polytechnic Institute, has been called to become the dean of the new school and professor of mechanical engineering; he will take up his duties in the fall of 1922. Professor Greene has served as manager and vice-president of the American Society of Mechanical Engineers and at present is chairman of the Research Committee of the Society, a member of the Boiler Code Committee and chairman of its Special Committee on Steam Piping. He is one of the Society's representatives on the Engineering Division of the National Research Council and on the executive board of the Federated American Engineering Societies.

A cable transportation company is to be organized in Japan with a nominal capitalization of 1,500,000 yen ($747,750), according to the Japanese press. It is to construct cable lines from the mountain districts to the railway terminus to enable the transportation of freight from these districts by electric power. The cables will carry loads of about 60 kwan (496 lbs.) at a speed of 4 mi. per hr.

Operating Accounting Under Uniform System

Each Item of Expenditure Classified and Recorded in Form to Segregate Costs in Various Plants and Operations—Definitions Determine Character of Expenditures—Examples of Accounts

This is the second half of a review of an accounting scheme for electrical corporations prepared by the National Association of Railway and Utilities Commissioners, with the assistance of the National Electric Light Association, and published and copyrighted by the Law Reporting Company of New York City. The first half of the review appeared on p. 6 of the July 2, 1921, issue of "Electrical Review." This notice of copyright by the Law Reporting Company, New York City, will also apply to the first installment of this review since it was inadvertently omitted from that portion when the article was divided in making up the issue of July 2. The information appearing in the first installment of our review of the accounting plans of the National Association of Railway and Utilities Commissioners, embodying balance sheet accounts, fixed capital accounts, operating revenue accounts and operating expense accounts, together with the following, are all covered in one accounting system.—EDITOR'S NOTE.

Proper accounting of operating costs is almost, if not quite as important as good operating practice. In fact, it is impossible in many cases to determine whether or not a given change in operating procedure has been for good or not, because of slack accounting methods. The accompanying accounting details, relative to the accounting of operating costs, are taken from the accounting scheme prepared by the committee on statistics and accounts of the National Association of Railway and Utilities Commissioners.

GENERAL INSTRUCTIONS AND DEFINITIONS.

Operating expenses defined.—"The term operating expenses as used in this classification means such expenses as are necessary to the maintenance of the corporate organization, the rendering of service required or authorized by law, the sale of merchandise, the production (including herein capital consumed), and disposition of commodities produced, and the collection of the revenues therefor. Expenses directly incident to the collection of nonoperating revenues and the maintenance of property from which nonoperating revenues are derived are excluded from operating expenses.

Definitions of certain terms used in connection with expense accounts.—"Except where some other meaning is clearly specified in the definitions of the accounts, the following words, wherever used hereunder have the meanings below stated.

"*Cost* means cash or money cost, and not price based on a term of credit.

"*Labor* means human services of whatever character.

"*Cost of labor* includes wages, salaries and fees paid to persons for their services.

"*Cost of materials and supplies* includes all specifically assignable transportation charges incurred in obtaining the delivery of such materials and supplies upon the premises of the purchaser, such as packing, drayage, freight, insurance, customs duties, commissions, etc., and cost of any special tests made thereon prior to their acceptance; and in case the accounting person or corporation desires it may include a suitable proportion of store expenses (when the materials and supplies are passed through stores) and the cost of further transportation to the place of consumption, and a suitable proportion of the expenses of the purchasing department, in which case a corresponding credit shall be made to the suitable expense account as hereinafter provided.

"*Cost of repairs,* when made by the accounting person or corporation, includes cost of labor expended and material consumed, and incidental expenses such as carfare, permits, inspection, etc., less salvage, if any.

"*Current maintenance* includes such expenses necessary to maintain the tangible property in a state of operating efficiency as do not result in a substantial change of identity in any particular unit of property. It includes the cost of minor replacements of small parts commonly called the cost of repairs, but it does not include the cost of replacing individual structures, facilities or units of equipment or important sections of continuous structures such as electric line. Current maintenance costs are chargeable to operating expenses and wherever the word "maintenance" is used in the definition of an operating expense account current maintenance is to be understood. The cost of replacing the larger units is chargeable to fixed capital from which the cost of the property replaced must be deducted.

Note.—"It is not required that the transportation element of cost shall be assigned with a greater degree of accuracy than to the nearest cent per unit of material or supply. Where a single transportation item covers a multitude of things the portion of the expense not assigned to specific things should be charged to the same account that store expenses are charged to.

Unaudited bills and vouchers.—"When bills covering operating expense items are not received in time for audit, and when vouchers are not made in time for inclusion in the operating accounts for the month in which the transactions occur, the items may be estimated and in such form charged or credited to operating accounts, and credited or charged to operating reserves, the necessary adjustments being made later when the bills and vouchers are taken into the accounts.

Delayed items.—"Delayed items are those representing transactions which occurred prior to the period covered by the income account, but which were not recorded currently. Such items may be charged or credited to the appropriate expense account for the fiscal period in which the

OPERATING EXPENSE ACCOUNTS.

- Production Expenses—
  - Steam Power Generation:
    - Operation:
      - Superintendence and labor.
        - Superintendence.
        - Boiler labor.
        - Engine labor.
        - Electrical labor.
        - Miscellaneous labor.
      - Power plant supplies and expenses.
        - Fuel.
        - Water.
        - Miscellaneous supplies and expenses.
          - Lubricants.
          - Production supplies.
          - Station expense.
    - Maintenance:
      - Maintenance of power plant.
        - Maintenance of station buidings.
        - Maintenance of steam equipment.
          - Maintenance of furnaces and boilers.
          - Maintenance of boiler apparatus.
          - Maintenance of steam accessories.
          - Maintenance of steam engines.
          - Maintenance of turbo-generator units.
          - Maintenance of electrical equipment.
          - Maintenance of main generators.
          - Maintenance of exciting apparatus.
          - Maintenance of control and protective equipment.
          - Maintenance of transformers and converting apparatus.
          - Maintenance of miscellaneous power plant equipment.
      - Steam generated—Apportionment account.
      - Steam from other sources.
  - Hydroelectric Generation:
    - Operation:
      - Superintendence and labor.
        - Superintendence.
        - Hydroelectric labor.
        - Station labor.
        - Miscellaneous labor.
      - Power plant supplies and expenses.
        - Water for power.
        - Miscellaneous supplies and expenses.
          - Lubricants.
          - Production supplies.
          - Station expense.
    - Maintenance:
      - Maintenance of power plant.
        - Maintenance of station buildings.
        - Maintenance of reservoirs, dams and waterways.
          - Maintenance of dams and intakes.
          - Maintenance of flumes and canals.
          - Maintenance of reservoirs and forebays.
          - Maintenance of penstocks and tail-races.
          - Maintenance of way and cars.
          - Maintenance of telephone system.
          - Maintenance of roads, trails and bridges.
        - Maintenance of hydroelectric equipment.
          - Maintenance of water turbines and water wheels.
          - Maintenance of turbo-generator units.
          - Maintenance of main generators.
          - Maintenance of exciting apparatus.
          - Maintenance of control and protective equipment.
          - Maintenance of transformers and converting apparatus.
          - Maintenance of miscellaneous power plant equipment.
  - Conversion and Storage Expenses:
    - Conversion expenses.
      - Sub-station superintendence and labor.
        - Sub-station superintendence.
        - Sub-station labor.
      - Sub-station supplies and expenses.
      - Maintenance of buildings and equipment.
        - Maintenance of sub-station buildings.
        - Maintenance of conversion equipment.
    - Storage battery expenses.
      - Storage battery superintendence and labor.
        - Storage battery superintendence.
        - Storage battery labor.
      - Storage battery supplies and expenses.
      - Maintenance of buildings and equipment.
        - Maintenance of batteries.
        - Maintenance of accessories.
        - Maintenance of buildings.
  - Transmission Expenses:
    - Transmission operation and maintenance.
      - Transmission superintendence.
      - Transmission supplies and expenses.
      - Operation of transmission lines.
        - Labor and expense—subways.
        - Labor and expense—overhead conductors.
        - Labor and expense—underground conductors.
        - Labor and expense—telephone system.
      - Maintenance of underground conduits.
      - Maintenance of transmission lines.
        - Maintenance of overhead conductors.
        - Maintenance of poles, towers and fixtures.
        - Maintenance of underground conductors.
        - Maintenance of telephone system.
  - Distribution Expenses:
    - Distribution operation and maintenance.
      - Distribution superintendence.
      - Distribution supplies and expenses.
        - Distribution maps and records.
        - Distribution office expenses.
        - Distribution miscellaneous expenses.
      - Operation of distribution lines.
        - Labor and expense—subways.
        - Labor and expense—overhead conductors.
        - Labor and expense—underground conductors.
        - Labor and expense—telephone system.
      - Meter operation.
        - Salaries and personal expenses, meter department.
        - Testing meters.
        - Miscellaneous expenses, meter department.
        - Removing and re-setting meters.
        - Removing and re-setting transformers.
      - Maintenance of underground conduits.
      - Maintenance of lines.
        - Maintenance of overhead conductors.
        - Maintenance of poles, towers and fixtures.
        - Maintenance of underground conductors.
      - Maintenance of services.
      - Maintenance of transformers and meters.
        - Maintenance of line transformers.
        - Maintenance of consumers' meters.
      - Maintenance of buildings and grounds.
  - Utilization Expenses:
    - Utilization operation and maintenance.
      - Commercial lamps—operation.
        - Commercial arc lamps.
        - Incandescent lamps—installation.
        - Incandescent lamps—renewals.
      - Consumers' installation and inspection work.
        - Inspection—consumers' premises.
        - Consumers' installations.
      - Municipal street lamps—operation.
        - Municipal street arc lamps.
        - Municipal street incandescent installation.
        - Municipal street incandescent renewals.
      - Maintenance of commercial lamps.
      - Maintenance of municipal street lighting equipment.
        - Maintenance of municipal street arc lamps.
        - Maintenance of municipal street incandescent lamps.

transactions are actually recorded. If, however, the amount of such items is relatively so large that its inclusion in the expense accounts for a single year would result in a seriously abnormal income statement, and no provision has been made through accruals to reserves or suspense accounts for anticipating such transactions, the accounting company may distribute the amount or any part thereof to 'Profit and Loss.'

Salvage and insurance.—"Salvage and insurance received in connection with maintenance jobs not involving deductions from fixed capital shall be credited to the appropriate maintenance account. * * *

"If the insurance for damaged property is relatively large, and is received before the repairs have been completed, a disproportionate credit to operating expenses may be avoided by crediting the amount of the insurance recovered to a suspense account to which the cost of the repair shall then be charged to the extent that it is covered by insurance.

"Insurance recovered in connection with personal injuries shall be credited to 'Injuries and Damages' or the appropriate subdivision thereof. Dividends distributed by mutual insurance companies shall be credited to the account to which the insurance premium is charged. Recoveries under fidelity bonds shall be credited to the account charged with the loss.

Retirement expense.—"An account is provided in which to include charges made in order that corporations may, through the creation of adequate reserves, equalize from year to year, as nearly as is practicable, the losses incident to important retirements of buildings, dams, etc., or of large sections of continuous structures like electric line, or of definitely identifiable units of plant or equipment. 'Losses' used above means in each case the excess of the original cost to the accounting company of the property retired plus the cost of dismantling or removing, over its salvage value at the time of its retirement. The cost of replacing minor parts, which is not re-

corded by any entries in the fixed capital accounts, and which is commonly called the cost of 'repairs' or 'maintenance' as distinguished from the cost of 'replacements' of large units, need not be provided for through a retirement reserve. The amounts charged to retirement expense should be upon a basis determined to be equitable according to the accounting company's experience and best sources of information, and should in all cases be sufficient to provide during a period of years a reserve against which can be written off all losses sustained upon the retirement of property for any cause whatsoever.

"A statement of the rule used by the accounting company for computing these charges shall be included in its annual report to the regulatory commission. If the accounting company so desires, it may file with the commission a verified copy of its rule for determining annual retirement charges, and refer to such rule in its annual report in place of repeating it in full each year.

Classification of corporations by revenue.—"For the purpose of this classification of accounts electrical corporations are divided into four classes as follows:

"Class A.—Corporations having average annual operating revenues exceeding $250,000.

"Class B.—Corporations having average annual operating revenues exceeding $50,000 but not over $250,000.

"Class C.—Corporations having average annual operating revenues exceeding $10,000, but not over $50,000.

"Class D.—Corporations having average annual operating revenues of $10,000 or less.

"In order that frequent changes may be avoided, the class to which an electrical corporation belongs may be determined by the average of its annual revenues for the three years next preceding the effective date of this accounting classification. If at the close of any fiscal year following the average of its annual revenues for the three next preceding years is greater than the maximum for the class in which the corporation has been grouped, it shall automatically be grouped with the higher class in which it falls by virtue of such increased annual revenues. Corporations engaged in new enterprises the annual revenue from which is not known in advance shall be classed in accordance with a reasonable estimate of their prospective revenue.

"The classification of operating expenses which follows is adapted to corporations in all four classes. The primary accounts are expanded and subdivided as will be indicated to meet the needs of each class. No separate definitions are stated for accounts which are thus divided, but the content of such accounts is to be found in the definitions of the final subdivisions. When such subdivisions are kept as primary ledger accounts it will not be necessary to keep also the account which has been subdivided.

"Each corporation will be expected to keep, so far as they are applicable to its business, at least the accounts provided for the class to which it belongs. Any corporation may, however, keep any or all of the accounts of the more extended schemes, provided for those corporations which are in higher revenue classes. If desired further refinements or extensions of the scheme of accounts to meet the needs of individual corporations may be made by subdividing the accounts herein established, provided that the integrity of the required accounts is not impaired. * * *

Detailed Information Pertaining to Operating Expense Accounts.

Note.—"If the accounting company operates two or more generating stations or if it generates energy by two or more different methods, such as by a steam power plant and a hydraulic power plant, it should keep (with the detail herein prescribed) separate accounts covering production at the several plants and so far as practicable for each process or method. Where two or more methods or processes are used, separate subaccounts should be kept for expenses common to two or more methods. Electric energy obtained from another company should be separately accounted for as in the case of that produced by a separate process or method.

Steam Power Generation.

Superintendence.—"This account shall include the salaries of superintendents and assistants, chemists, day and night foremen and station clerks; and also that portion of the salaries of the engineering staff chargeable to steam generating plant operations.

Boiler labor.—"This account shall include labor in boiler room and elsewhere in and about the premises having to do with making steam.

"Principal items: Fire room engineer and assistants; water tenders, firemen, coal handlers, boiler cleaners and feed pumpmen.

Engine labor.—"This account shall include labor on prime movers.

"Principal items: Chief engineer and assistants, engineers, oilers, wipers and machinists

Electrical labor.—"This account shall include all labor in connection with the electrical apparatus and devices, beginning with the dynamos direct connected or belted to the prime movers and including the switchboard, feeder terminal board, and to the point where the electric current leaves the station for the transmission or distribution system.

"Principal items: System operators or load dispatchers; foremen regulators, regulators and assistants, switchboard men, brushmen, wipers, wiremen.

Miscellaneous labor.—"This account shall include salaries and wages of all employes in and about the steam power generating plant engaged in operating the plant, whose time is not chargeable to any of the foregoing steam power plant labor accounts. This covers such labor as that of watchmen, janitors, elevator men and messengers; employes engaged in cleaning buildings and yards; and other general labor, excluding maintenance labor.

Fuel.—"This account shall include the cost of all fuel used for steam, whether coal, oil, gas or other fuel, f. o. b. station or storage pile. This will include the invoice cost of fuel, freight, switching, rent of railroad sidings, demurrage, cost of unloading from cars or boats to wagons, and cartage to point of delivery at plant for storage, or unloading from scows or cars and conveying to place of storage. In case coal is transferred from one place to another this cost should also be included, and any discrepancy between the actual amount of coal on hand and that recorded on the books of the company should likewise be taken care of in this account.

Water.—"This account shall include the cost of water for boilers, for condensers and for cooling engines; also boiler compound. Water used

for general station purposes should not be included.

"If water is purchased, charge at the contract price or the meter rate.

"If water is pumped by the company, charge here the cost of pumping.

"This account should include all labor cost in connection with the handling of water, such as operating the pumping station, and expense such as cost of chemicals used in purification and filtration.

Lubricants.—"This account shall include the cost of lubricants for machinery in the steam generating plant. This does not include oil for transformers, grease for wagons, or oil for lanterns, etc.

Production supplies.—"This account shall include the cost of all supplies, tools, etc., used in the steam generating plant which are consumed in the operating process, the replacement of which does not constitute a repair or renewal.

"Principal items: Waste, packing, wipers, gage glasses, gage washers, manhole gaskets, handhole gaskets, fire room tools, steam and air hose, screws, nails, tools, dynamo brushes.

Station expense.—"This account shall include the general and miscellaneous expenses in the steam generating plant not specifically chargeable to other accounts.

"Principal items: Lighting, heating and cleaning system, fire protection system, janitor's supplies, ice water, meals and car fares, stationery, telephone and toilet service, care of streets, yards and sidings.

Maintenance of station buildings.—"This account shall include the cost of maintaining steam power plant buildings and permanent fixtures therein, including furniture, as follows:

(a) SUNDRIES.—"Repairs to furniture, fixtures and other such property in and about the steam generating plant not specifically provided for elsewhere. Alterations, if not provided for by a reserve, should be charged under this classification.

(b) STATION STRUCTURES.—"Repairs to buildings and permanent fixtures therein.

"Principal items: Plumbing, windows, sashes, roof, doors and walls; heating and lighting systems; grounds and streets, vaults, sheds, pits, sidewalks, elevators; lockers, fire protection system, painting.

Maintenance of furnaces and boilers.—"This account shall include the cost of maintaining boilers and furnaces and their specially provided foundations and settings.

"Principal items: Brick work, metal smokestacks, bridge wall, arches, jambs, grate bars, stoker bars and webbs, furnaces, valves, superheaters, damper regulators, tubes.

Maintenance of boiler apparatus.—"This account shall include the cost of maintaining feed water, coal and ash handling systems, and auxiliary apparatus in the fireroom.

"Principal items: Feed pumps, blower engines, coal conveyors, diggers, trolley and cable towers, crusher and belt lines, brackets, wheels, chutes and gates, ash conveyor cars, winches, motors, buckets, shaft, chain and wheels; filters, boiler compound injector and pump; heaters, primary and secondary; economizers and water meters.

Maintenance of steam accessories.—"This account shall include the cost of maintaining the piping system in connection with the making of steam and delivery thereof to the prime movers. This covers those steam accessories included in fixed capital account, 'Boiler Plant Equipment,' i. e., those not considered a part of the steam engine.

"Principal items: Water feed piping, cold main, hot main, water suction, valves, joints, jackets, ash pit drains and ash pocket siphons, oil drains from engine crank pits, receiving tanks, filter pumps to engine valve, steam and exhaust line systems, sewer connections and air line.

Note.—"When the system for supplying boiler or condenser water is elaborate as when it includes a dam, reservoir, canal and pipe line, the cost of maintaining it shall be charged to a special subaccount under 'Maintenance of Station Buildings,' with the title, 'Maintenance of Water Supply Structures—Steam.'

Maintenance of steam engines.—"This account shall include the cost of maintaining steam engines, whether reciprocating or rotary, used in the power plant. This covers the cost of maintaining apparatus auxiliary to the prime mover, such as condensers, tubes, heads, doors, etc., pumps, air and circulating; wet vacuum, dry vacuum and oil systems, but not the power conveying apparatus.

Note.—"This account may be subdivided between the expense of maintaining the prime mover and the expense of maintaining the auxiliary apparatus.

Maintenance of turbogenerator units.—"This account shall include the cost of maintaining steam turbine-driven generating units. This covers the cost of maintaining condensers, air and circulating pumps, lubricating systems and similar appurtenant apparatus, but not the cost of maintaining the steam pipe leading from the boiler nor the exhaust pipe.

Note.—"This account may be subdivided to show separately the cost of maintaining the prime mover and appurtenant apparatus.

Maintenance of main generators.—"This account shall include the cost of maintaining dynamos, alternators and other electric generating apparatus driven by steam.

Maintenance of exciting apparatus.—"This account shall include the cost of maintaining exciters, motors, motor generators, boosters, regulators and exciting batteries used in the steam generating plant.

Maintenance of control and protective equipment.—"This account shall include the cost of maintaining switches, circuit-breakers, busses, current and potential transformers, relays, indicating and recording instruments and switchboard panels, lightning arresters, reactances and ground resistances used in the steam generating plant, and wires and cables used in conjunction with the foregoing.

Maintenance of transformers and converting apparatus.—"This account shall include the cost of maintaining transformers and converting apparatus in the steam generating plant other than that used primarily for transmission and distribution purposes.

Maintenance of miscellaneous power plant equipment.—"This account shall include the cost of maintaining miscellaneous equipment, such as belts, pulleys, hangers, countershafts, machine tools, cars, locomotives, locomotive cranes for power plant purposes, and all other equipment properly includible in fixed capital account."

Types of Contactors and Relays for Motor Control

Solenoids, Electromagnets, Induction Motors and Wattmeter Movements Used to Actuate Relays—Springs, Dashpots, Shading Coils and Bellows Prevent too Rapid Movement of the Contacts

By G. J. KIRKGASSER and E. W. SEEGER

Plunger Electromagnets.—Magnetic contactors and relays are made up of two essential parts—the operating solenoid and the contact making mechanism. The contacts vary in size, material and contact pressure according to the service to be performed, and in the same way the solenoid varies, the design depending on the work to be done. The simplest type of solenoid consists of an iron plunger and a coil, as shown in Fig. 106*a*. When current flows in the coil *A* the plunger *B* is drawn into the coil. Fig. 107 shows the pull obtained with this arrangement, and it will be noted that the pull is very slight when the plunger first enters the coil, increasing rapidly until the maximum is reached and again tapering off and becoming zero when the plunger becomes centered in the coil. The pull may be materially increased by providing a stationary iron plug as shown in Fig. 106*b*. With this arrangement the pull due to the "solenoid effect," that is, the force exerted on plunger *B* by coil *A*, is the same as before, but an additional pull is obtained due to attraction between the plunger *B* and the plug *C*. The pull due to attraction between the plunger and the plug may be increased by providing a return path in iron for the magnetic flux, as shown in Fig. 106*c*. If the iron plunger *B* is allowed to come directly into contact with the iron plug *C* the residual magnetism is in some cases sufficient to prevent the release of the plunger after the coil is de-energized. This difficulty may be overcome by placing a thin non-magnetic spacer, usually brass or copper, between the two iron surfaces. The arrangements shown in Fig. 106*a* and Fig. 106*b* are seldom used commercially, but the construction shown in Fig. 106*c* is used extensively for brake solenoids, magnetic contactors, relays, etc.

Flat and Cone Plungers.—The pull obtained with a plunger-type electromagnet with a flat plug and plunger is indicated by curve *A*, Fig. 108. When the plunger is 1 in. away from the plug the pull is only 6 lbs., but as the plunger approaches the plug the magnetic flux and therefore the pull increases, and the pull is 16 lbs. at 0.5-in. stroke and 40 lbs. at 0.25-in. stroke. The characteristics of a plunger electromagnet may be varied by changing the shape of the plug and plunger, and curve *B*, Fig. 108, shows the pull obtained when the plunger is made conical instead of flat. The pull varies with the angle of the cone, but it has been found that the best results are obtained with a cone angle of about 60 deg.

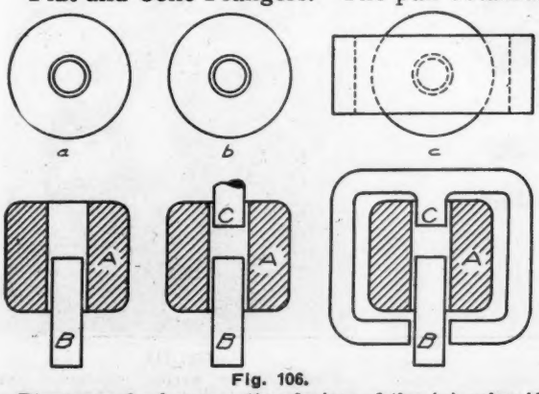


Fig. 106.

Diagrams of relay operating devices of the (*a*) solenoid and plunger type, (*b*) solenoid and plunger type with stop, and (*c*) the electromagnet-plunger type.

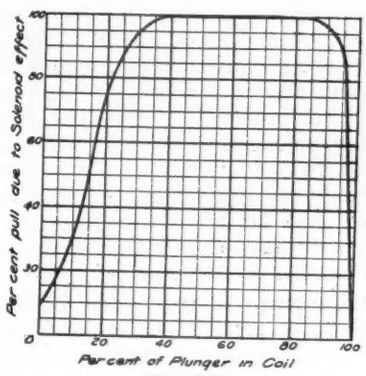


Fig. 107.

Diagram of the "pull curve" of an operating device of the solenoid and plunger type.

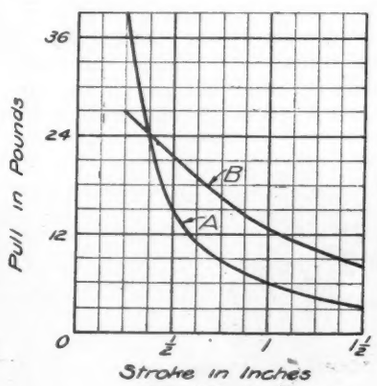


Fig. 108.

Diagram of the "pull curves" of devices of the electromagnet-plunger type.

Electromagnets with cone plungers are, in general, used where the starting pull is appreciable or a long stroke is required, and where a high "sealing" pull is not essential. Flat plungers are more suitable where the starting pull is small, but

a high pull at the finish of the stroke is required, as on magnetic contactors.

Clapper-Type Electromagnets.—The clapper-type electromagnet consists of an iron frame, a stationary iron core, pivoted armature or clapper, and an operating coil. Although not as efficient magnetically as the plunger electromagnet the clapper-type electromagnet is simpler, cheaper, more accessible, and, in general, more durable, and for these reasons is being very generally used for magnetic contactors.

Fig. 109 illustrates a 300-ampere contactor of the clapper type. The contacts are of hard drawn copper and no leaf brushes are used, a high contact pressure being depended upon for obtaining the necessary current carrying capacity. Shunt contactors are used for opening and closing motor and power circuits, for reversing and for motor acceleration when controlled by the proper time, current or counter-voltage relays. They are also used for cutting resistance in and out of motor field circuits and for relays of various kinds. Although the contactors shown are arranged to handle only one circuit they are commonly built to control two or more circuits. Single-pole contactors are, in general, more satisfactory due to the fact that the different circuits must be insulated from each other when more than one circuit is handled by a contactor.

Direct-Current Shunt-Type Contactors.—Shunt contactors receive their name from the fact that they are operated by shunt or voltage coils. A 400-ampere shunt contactor utilizing a plunger-type electromagnet is shown in Fig. 110. When the coil *A* is energized the plunger *B* is lifted and carries with it the contact lever *C*. The parts are arranged so that the renewable copper contact *D* makes contact with the carbon block *E* just before the plate *F* touches the leaf brushes *G*. The circuit is therefore always made and broken on the easily renewable contacts *D* and *E*, and the brushes which carry the current are protected. When the contactor is closed the main current passes from the stud *H* through the bar *J* to the blowout coil *K*, thence to the brushes *G*, through the plate *F* and through conductor *L* to the stud *M*.

The magnetic contactors described above are all of the normally open type; that is, the main circuit is broken when the coil is de-energized. Normally closed contactors utilize a spring for closing the main contacts when the coil is de-energized. The magnet of this contactor must exert a considerable pull at the beginning of its stroke in order to overcome the tension of spring, and for this reason the movable core and the stationary plug are cone shaped. When the magnetic pull overcomes the spring tension the contacts are separated quickly. Contactors of this type are used for dynamic braking, for inserting resistance in motor shunt-field circuits, and for control relays.

Series and Lockout Contactors.—Series and lockout contactors are used for automatic motor acceleration and are provided with series coils connected directly in the armature circuit. The arrangement of the magnetic circuit is such that the contactor will not close on high current, but will respond when the motor accelerates and the current falls to a predetermined value.

In starting a motor a high initial surge of current is obtained, and as the motor accelerates and the current decreases the first series contactor closes and short-circuits the first step of the resistor. A second surge of current is then obtained and the current again decreases as the motor accelerates until the second contactor closes, and so on until the motor attains full speed.

Fig. 111 shows one type of series contactor, and Fig. 113 shows the arrangement of the magnetic circuit of this device. The iron frame of the contactor is represented by *A*, *B* represents the plunger, and *C* the operating coil. The diameter of the plunger *B* is reduced at the lower end where it passes through the frame, and for this reason the lower part of the plunger becomes saturated and part of the flux passes across the air gaps *D*. On high currents sufficient flux passes across the air gap *D* to hold the contactor

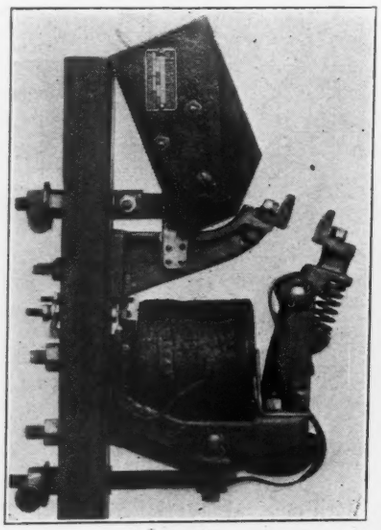


Fig. 109.
View showing a 300-ampere shunt contactor of General Electric Co. make with the arc shields lifted to show the contact construction.

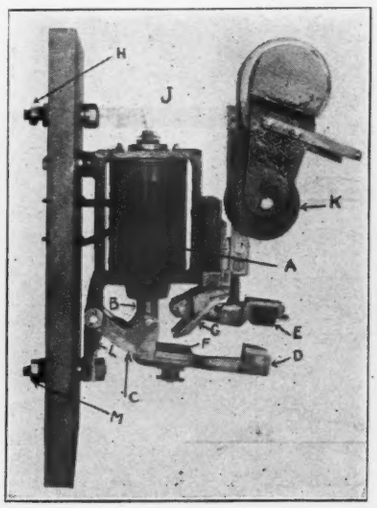


Fig. 110.
View showing a 400-ampere shunt contactor operated by a plunger-type electromagnet.

Fig. 111.
Plunger-type series contactor of Electric Controller & Manufacturing Co. make.

in the open position, but as the current decreases less flux exists in the air gap. When the current falls to the value for which the contactor is adjusted the upward pull on plunger *B* overcomes the lockout effect, the plunger is lifted and a copper disc makes contact with the two leaf brushes shown in Fig. 111. The current at which the contactor closes is adjusted by changing the length of the air gap *D*.

Fig. 112 shows the construction and Fig. 114 the magnetic circuits of another type of series contactor. This contactor consists of an iron frame *A*, a clapper *B* with a tail piece *E*, and a coil *C*. The area of the iron circuit is reduced at *D*, and for this reason part of the magnetic flux passes through the tail piece *E*, as shown by the dotted lines. At high currents sufficient flux exists in this path to prevent the closing of the contactor, but when the current has fallen to a predetermined value the attraction between the core *F* and the clapper *B* is sufficient to overcome the pull of the tail piece *E*, and the contactor closes.

The lockout contactor shown in Fig. 115 is equipped with two coils, the upper or closing coil *A* and the lower or lockout coil *B*. When the coils are energized the magnetic circuit of the closing coil becomes saturated, while the lockout coil circuit, which has very little iron, does not. For this reason the contactor is locked open on high currents, but is allowed to close when the current has fallen to the value for which the contactor is adjusted. The contactor may be set to close at a lower value of current by moving the disc *C* closer to the lockout coil.

Alternating-Current Contactors. — Contactors for a-c. service differ in several respects from those used for d-c. service. On account of

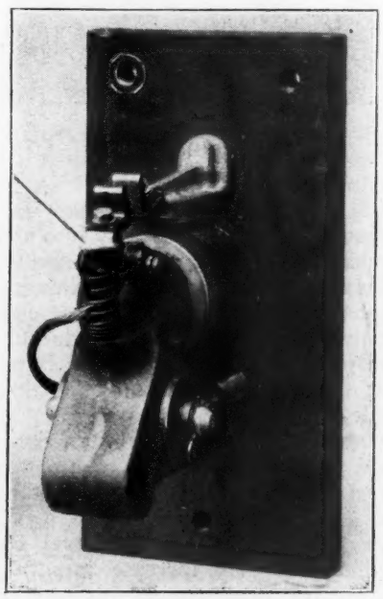


Fig. 112.
Clapper type series contactor made by the Westinghouse Electric & Manufacturing Co.

the iron losses due to eddy currents it is necessary to build the magnetic circuits of a-c. contactors of laminated iron, and for this reason these contactors are, in general, not as rugged as those used on direct current. The flux and therefore the pull of an a-c. magnet passes through zero twice during every cycle, causing the magnet to vibrate. This difficulty is overcome by placing a shading coil in the pole face of the magnet. The shading coil is a short-cir-

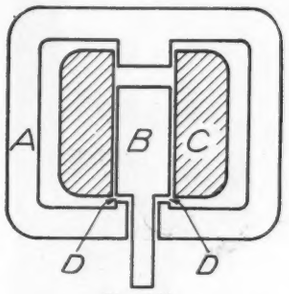


Fig. 113.
Magnetic circuits of series contactor shown in Fig. 111.

cuited turn of wire which produces a local flux out of phase with the main flux, so that the pull on the clapper or plunger never passes through zero. In Fig. 118 *A* represents the clapper of

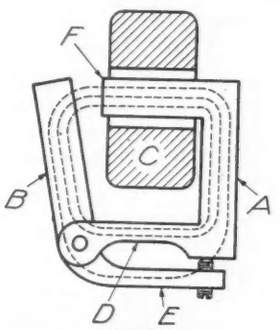


Fig. 114.
Magnetic circuits of the series contactor shown in Fig. 112.

the magnet, *B* the frame, *C* the coil, and *D* the slot cut in the pole face of the frame for accommodating the shading coil. In this diagram *E* represents the path of the main flux, *G* indicates the position of the shading coil, and *F* shows the path of the local flux produced.

Coils of a-c. electromagnets are self-protecting; the current is high when the magnet is in the open position, but decreases as the magnet approaches the sealed position. The pull of an a-c. electromagnet is practically constant throughout its travel. When used for operating contactors the starting pull is greatly in excess of the requirements, causing the plunger or clapper to attain a high velocity and to close with a decided "slam." This effect can be partially overcome by placing resistance in series with the operating coils.

Both the plunger- and clapper-type of electromagnets are used for a-c. contactors, but the clapper type is generally preferred. Fig. 116 shows a 300-ampere double-pole contactor of the clapper type as used in a-c. automatic motor-starter construction.

Magnetic Blowouts.—Magnetic blowouts are used on practically all contactors which are required to interrupt motor circuits. They are not usually required on accelerating contactors and are unnecessary if the circuit is broken under oil. Fig. 119 shows the usual construction of a magnetic blowout. The blowout coil *A* is wound

on an iron core *B* which is held in place between the pole pieces *C* and *D*. Current flowing in the circuit through the coil *A* produces a magnetic field between the pole pieces *C* and *D*. When the

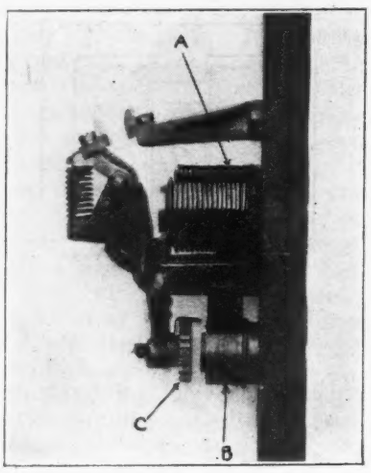


Fig. 115.
Magnetic lockout contactor made by the Cutler-Hammer Manufacturing Co.

contactor opens the circuit the arc which is drawn between the contacts *E* and *F* is forced upward in the same way that the armature conductors on a d-c. motor move across the magnetic field.

Contacts.—The contact-making parts of magnetic contactors are usually of carbon, brass or copper, drop forgings or hard-drawn copper being used principally. In those cases where the current must be carried continuously, but the circuit opened and closed infrequently, copper-leaf brushes protected by arcing contacts are often used. For steel mill and other heavy intermittent duty where the circuits are made and broken frequently leaf brushes are seldom used, but copper-to-copper butt contacts, as shown in Fig. 115, are preferred. Carbon-to-copper contacts are necessary on elevator or similar service where it is essential that the contactor should not "freeze" in the closed position.

Series or Current Relays.—Series relays are used principally in combination with magnetic

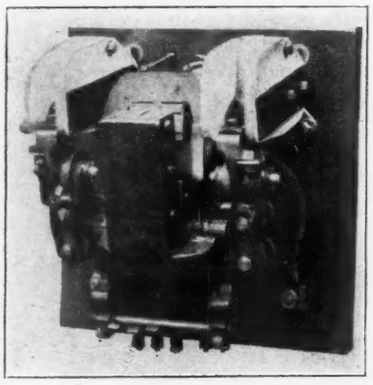


Fig. 116.
Double-pole, 300-amperes a-c. contactor.

contactors of the shunt type for obtaining automatic motor acceleration. Some series-relay controllers are provided with only one relay which causes the accelerating contactors to close one after another in proper sequence. This arrangement necessitates the use of a number of interlocking contacts which are not required when a relay is provided for each accelerating contactor. Series-relay controllers are more complicated than those of the lockout type and are seldom used on direct current except where speed regulation or multispeed control from a master switch is required.

Lockout contactors are not practicable on alternating current, series relays being used with the coil of the relay placed in the primary circuit when squirrel cage motors are used, and in either the primary or secondary when the motors are of the slip-ring type. Fig. 117 shows a 3-phase series relay designed for use with slip-ring motors. One of the coils *C* is connected in each phase of the secondary circuit of the motor, and when the primary windings are connected to the supply lines current flows into the coils *C*, the clapper *A* is attracted and the circuit for the coil of the succeeding contactor is broken at *B*. As the motor accelerates the current decreases, and at a predetermined point, depending on the setting of the adjusting nut *D*, the clapper *A* is released and the contactor controlled by the relay is allowed to close. Each accelerating contactor

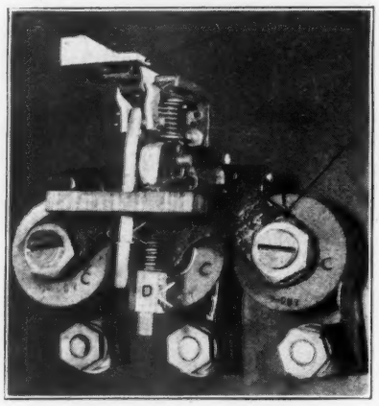


Fig. 117.
View of a 3-phase series relay.

in closing short-circuits part of the starting resistance and brings another relay into action, and so on until all of the resistance is short-circuited and the motor is operating at maximum speed.

A 3-phase relay is, in general, more quiet and reliable than a single-phase relay, due to the fact that the pull on the 3-phase relay is practically constant for a given current, while the pull on the single-phase relay is pulsating.

Current relays similar in construction to those described above are sometimes used to insert resistance in the motor circuit when the load increases beyond a certain value. Relays are used for this purpose on electric-shovel controllers where the load may increase rapidly. If the motors are not protected in this way it is difficult to keep the circuit-breakers closed, and if the circuit-breakers are not given a high enough setting to prevent opening the motors soon become overheated.

Relays of this type are also used in some cases on rolling-mill drives where a flywheel is provided for limiting the current drawn from the line. When the current reaches a predetermined

value the relay operates and causes a contactor to insert resistance in the motor circuit. The motor then tends to decrease in speed and allow the flywheel to give up some of its stored energy. When the load decreases the resistance is short-circuited and the motor again accelerates to maximum speed.

Vibrating Field Relays.—Vibrating field relays for use with d-c. shunt and compound motors are usually provided with two coils connected in series in the armature circuit. When the motor is started the clapper *A*, Fig. 120, is attracted, and the shunt field resistance which is connected across the relay contacts is short-circuited. Full field strength during starting is provided in this way, and the relay contacts remain closed until one of the series coils is short-circuited with the last step of armature resistance. The motor current flowing through only one series coil is not sufficient to retain the clapper *A*. Consequently it is released and the resistance is inserted in the field circuit, causing the motor to increase in speed. The motor current also increases, and at a predetermined value the relay again closes. The relay continues to close and

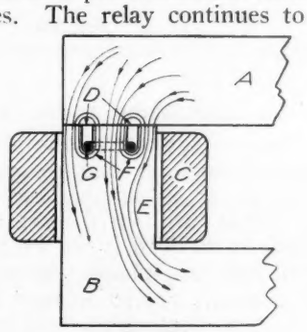


Fig. 118.
Arrangement of shading coils on a-c. contactor.

open in this way, increasing the motor speed each time until maximum speed is reached. The screw *D* and the adjusting nut *C* which carries the tension of spring *B* are provided for varying the current values at which the relay operates.

When a motor is operating at high speed with resistance in the shunt-field circuit, and this resistance is suddenly short-circuited to decrease the speed of the equipment, a high voltage is generated by the motor armature which tends to deliver current back into the supply line. To prevent damage under these conditions vibrating relays with normally closed contacts are frequently used. These relays insert the field resistance when the motor current reverses, and in this way gradually reduce the motor speed to the lower value desired.

Timing Relays.—Various methods are used for obtaining timing on motor controllers. Where long time intervals are required contact-making clocks are utilized; small pilot motors operating contacts through a train of gears are sometimes furnished, and in other cases timing is obtained by means of a bellows. Timing by dashpots is, however, simpler, cheaper and just as reliable as any of the other methods, and is used almost exclusively where the time interval required does not exceed 30 sec.

Satisfactory results can be obtained with direct current by means of a solenoid retarded by a dashpot. This method is not satisfactory with alternating current because the solenoid is noisy and the timing variable. For this reason dashpot

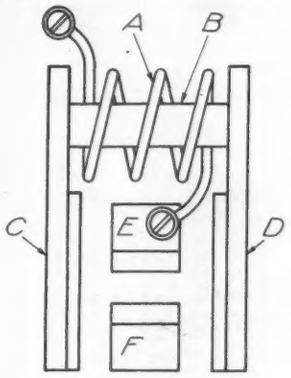


Fig. 119.
Illustration showing construction of magnetic blowout.

relays of the gravity type are used on alternating current. When the solenoid is energized the plunger is attracted and the contact bar is immediately moved to its upper limit of travel. The solenoid is then de-energized, the plunger released and the mechanism falls, its motion being retarded by the oil dashpot.

Overload Relays.—There are two general types of overload relays. Instantaneous-trip relays are those which respond immediately when the current in the relay coil reaches the value for which it has been adjusted. Time-element overload relays are provided with means for delaying the action of the relay, and with this type

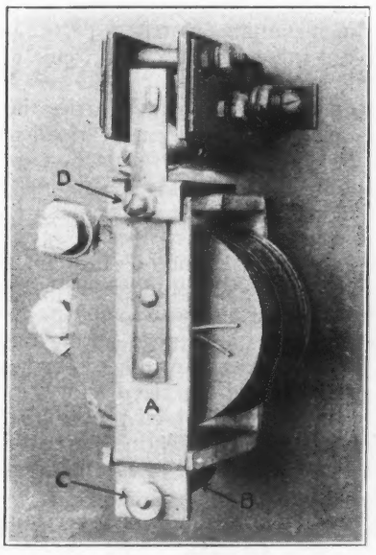


Fig. 120.
View showing a vibrating type field accelerating relay.

tripping occurs quickly on heavy overloads, but a longer time is required on light overloads.

Instantaneous-trip relays are of small value on d-c. motor controllers because of the accelerating currents. Although adequate protection can be provided in some cases, where the motor starts unloaded, the accelerating current is usually at least 150% of full-load current. The relay must, of course, be set above this value, and for this reason does not give real overload protection. The conditions are even worse on a-c. controllers. The accelerating current is seldom less than 200%

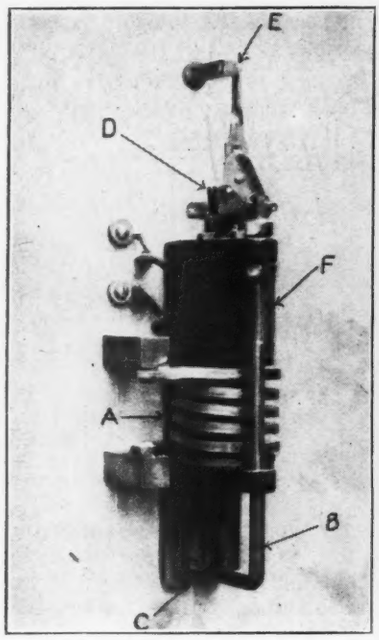


Fig. 121.
Instantaneous trip overload relay.

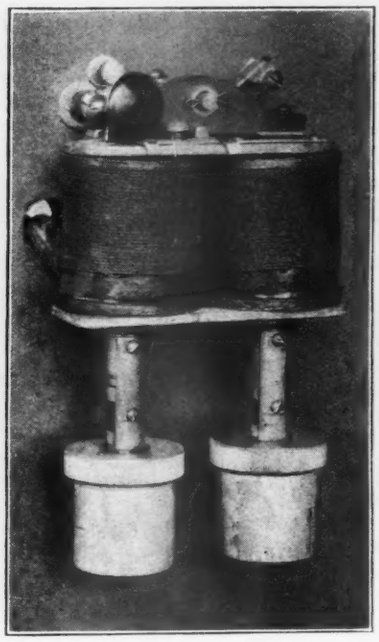


Fig. 122.
Time-element overload relay with two coils and manual reset.

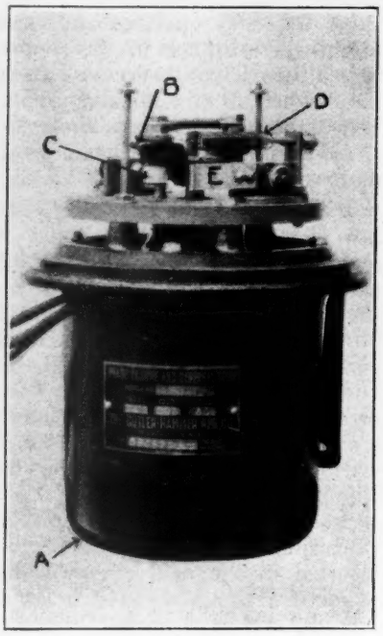


Fig. 123.
Phase-failure and reversal relay.

of the full-load value, and when squirrel cage motors are connected directly to the supply lines the starting current may be 600% of full-load current or more. For this reason time-element relays are used almost exclusively with a-c. equipment.

Fig. 121 shows the construction of a d-c. relay of the instantaneous-trip type. The coil *A* is connected in series with the circuit to be protected, the tripping current being set by means of the adjusting rod *B*, which varies the position of the plunger *C*. When an overload occurs the plunger *B* is lifted and a projection on the end of the plunger strikes the insulating block *D*, opens the control circuit at *E*, and causes the magnetic contactors to release.

In some cases a shunt holding coil *F* is provided which retains the plunger in the upper position, thus preventing closure of the contacts *E* until the relay has been reset by opening the circuit of coil *F*. There are other relays similar in operation to the one described above, except that a dashpot is provided which prevents tripping of the relay on high accelerating currents of short duration, but allows the relay to operate if an overload is maintained.

Fig. 122 illustrates a type of relay used on polyphase a-c. circuits. Two series coils are provided, each operating on a plunger retarded by an oil dashpot. An overload in any phase causes one of the plungers to be lifted. The contact mechanism is held closed by a latch, and when once tripped the circuit remains open until reclosed by hand. There are several other types of overload relays which are used to a limited extent. In one of these the current is passed through a wire under tension. When an overload occurs the additional heat generated causes the wire to lengthen and trip a contact mechanism.

Phase-Failure and Reverse-Phase Protection.—Failure of one of the phases of a polyphase system is usually due to the blowing of a fuse, and frequently occurs while the motors on the line are running. If one phase fails while an induction motor is running the motor will continue to operate without damage as a single-phase machine if the load is not excessive. The current in the operating phases will, of course, increase, but adequate protection may be obtained by the use of time-element overload relays.

Phase reversal may occur when changes or repairs are made on the supply lines. If the phases of an induction motor are reversed the direction of rotation is reversed, and for certain classes of machinery, such as mine fans, elevators, etc., it is essential that protection be provided against this possibility. Nearly all of the phase-reversal relays which are being manufactured at the present time are, essentially, small squirrel cage motors. These devices cause a contact to be closed when the phases are in the correct relation, but break the contact when the phases are reversed, or if one phase is dead. Fig. 123 shows a relay of this type with a small squirrel cage motor mounted in the base *A*. The contact arm *B* is connected to the motor shaft and carries the contact *C*. When the phases are in the correct relation the torque of the motor is sufficient to overcome the pull of the adjusting spring *D*, and the contact *C* revolves until it touches the finger *E*.

Miscellaneous Relays.—Relays are used for a number of other purposes in connection with motor-control apparatus. A relay similar in construction to the one shown in Fig. 120, but which responds to variations in frequency, has been developed and used for the automatic acceleration of synchronous motors. Relays of the lockout type have been used with alternating current for the automatic acceleration of both slip-ring and squirrel cage motors. These devices are similar in construction to the lockout contactor shown in Fig. 115.

EDITORIAL COMMENT

Protest Oppressive Revenue Features

Vigorous protest on the part of business men is being urged by P. W. Drackett, Sr., president of the Industrial Division of the Cincinnati Chamber of Commerce, against the proposed increase in rates of postage and the $0.02 revenue on every bank check issued. These recommendations, coming from Secretary of the Treasury Mellon, and promulgated, so far as the postage increases are concerned, by Postmaster-General Hays, are not given the serious attention which they should receive, asserts Mr. Drackett, who warns business men that the effect of the adoption of these suggestions will add a much greater burden to the already troubled business situation than may appear at first glance.

"Take the matter of increase in special delivery charges alone," said Mr. Drackett, "and you have a fair idea of the hardship these proposed new regulations will work on the already oppressed business of the country. Mr. Mellon suggests an increase of 150% in the charges for delivering special letters—an increase of from $0.10, the present rate, to $0.25. In round numbers, there are 785,000 pieces of special delivery mail distributed through the Cincinnati post office annually. Under the proposed new schedule, that would mean an increase of about $120,000 in special delivery fees alone. This service is used to expedite business, and if the proposed increase is established it will mean a slowing up of business, as many of the communications now being sent by special delivery will be committed to the regular mails, thereby prolonging the time of delivery.

"In the matter of first class postage, on which an increase of $0.01 over the present rate of $0.02 is proposed, I understand the Cincinnati office alone handled 700,000,000 pieces of mail last year for distribution to outside points, and received 230,000,000 pieces for distribution in Cincinnati. Under Mr. Mellon's proposal this would mean an added expense of not less than $7,000,000 to local letter writers, figuring every letter sent out on a $0.03 basis only, while those sending letters to Cincinnati would be subjected to an additional expense of $2,300,000.

"This also applies most forcibly to the proposed tax on bank checks. Eighty per cent of the business of this country is done on credits, and placing a stamp on every one of the billions of checks issued annually would not only mean a large amount of extra work, but also would prove a costly practice with firms doing a large business through banks. This tax also would hinder the efficient operation of business by delaying collections in many instances, as some customers would intentionally avoid placing the tax stamp on their checks in order that more time could be gained on their account, or the receiver of the check be compelled to pay the tax.

"These are some of the facts which enter into the consideration of the proposed postage and banking laws, and it seems to me that business men can not start too soon, or be too vehement, in voicing their protests."

ELECTRICAL REVIEW agrees thoroughly with the above and believes the matter mentioned should have prompt attention. While the new imposts now appear to have been eliminated from the pending bill, they are not unlikely to be renewed and railroaded through at the last minute. Protests against them, therefore, are still quite timely.

System Trouble and Protective Relays

Increasing concentration of generating capacity created the need of more versatile and reliable protective equipment than that which served with satisfaction on the smaller or purely local system. The development of a number of types of protective relays resulted as the response to this new need. A large number of relays, functioning in various ways, have now been in service for some time, and a considerable experience has been had with them in actual operation. A. A. Meyer, in presenting a committee report at the recent convention of the American Institute of Electrical Engineers, reviewed certain facts and conclusions drawn from an investigation of the functioning of protective relays. That part of Mr. Meyers' report pertaining to this question follows:

"From replies to a request for data on system troubles experienced during the year 1920 information was received from a number of the larger companies.

"Some of the replies include numerous cases of improper functioning of relays, but which were not serious in affecting the system. They could hardly be classed in the same category the committee considered for investigation. Moreover, several of such cases were cited without any

word of explanation as to the possible cause of improper functioning. It would take considerable time and study to analyze all such cases of false tripping and draw any valuable deductions. I believe the committee should confine its attention first to the cases which seriously affect the system as a whole.

"Among the most noteworthy cases the following performances and factors are of interest as affecting the system as a whole: Relays are reported as functioning too promiscuously on a transmission system. Instead of the relays close to the source of trouble functioning and isolating the trouble at once these relays for various reasons, and, as a consequence, relays elsewhere on the system operate and shut down large sections if not the entire system. The reasons for the relays failing to isolate only the section in trouble are such as incorrect connections, improper settings and shortcomings in the relays themselves when called upon under abnormal conditions on the system, accompanied usually by low voltage. Several cases were cited where low pressure delayed reverse-power relays from functioning in the time that was intended. Some transmission systems comprise a series of sections with graded settings, the relays in each section being set a trifle above or below the settings on the neighboring sections. Where the series contains many sections the increments in the settings necessarily have to be small to avoid too high a setting on the section close to the source. In some cases the increments are too low and, due to slow circuit-breaker operation, isolation of a fault is sometimes obtained by cutting out sections in additions to the desired one. In other cases the increments are too large, and a fault occurring in a section close to the source is held connected too long to a system, and as a result the initial fault drags so hard on the generators as to throw them out of step, and a real system disturbance follows. Some desire has been expressed for the need of current-limiting feeder reactors to avoid such a heavy drag on the generators due to a fault near the station. System troubles have also arisen out of small initial trouble in several cases, due to circuit-breakers of inadequate interrupting capacity. Duties on circuit-breakers not infrequently outgrow their capacity on fast growing systems. It is quite essential that the capacity be checked up occasionally and compared to the duty which might be expected.

"Another noteworthy factor responsible for system troubles comes through the practice of providing low-voltage releases on powerhouse auxiliaries. In several cases it was reported that low main bus pressure caused the plant auxiliaries to drop off, thereby making matters worse. The practice of providing such protection on plant auxiliaries needs careful reconsideration in, no doubt, many cases."

These remarks, based on a serious study of actual operating conditions, reveal certain present weaknesses in relay practice. It seems quite evident that the relays do what they should do; that is, function when a given combination of physical conditions exist. Continued study of relay performance will, without a doubt, increase the fund of information available until within a short time it will be possible to install relay equipment that will be 99% perfect in operation—that will do what is intended; that is, protect the system under every combination of possible conditions. Criticisms of relay performance, where relays have failed to function as desired, overlook the facts that most failures result from incorrect application, and that the modern power system could hardly function at all without relays.

The Reactive Meter

The evils of operating at a low power-factor are so well known as to need no special comment. Wattless current requires capacity in generating equipment, lines and transformers, and it interferes with good regulation. It is generally acknowledged that the customer having a poor power-factor, as so often occurs from the operation of underloaded induction motors, should be penalized in his rate. There are a variety of schedules for bringing in this element of charge.

A method which has been found very satisfactory and convenient is to install a separate meter so arranged as to measure the reactive volt-amperes, and to provide in the contract for a definite charge based on the reading of this meter. Such a charge is comparatively easy to explain to the customer. Wherever conditions are found to be severe enough to warrant it such a meter can be installed, otherwise it can be omitted. This assumes an extra charge proportional to the wattless current which is, perhaps, the most equitable that can be employed.

Where other methods of charging have been established the use of the reactive meter is not so simple, but it may still be employed. Thus, where a demand charge is modified according to power-factor, or a penalty applied where the power-factor averages less than a specified value, the power-factor itself must be determined, and this can be done by means of the reading of the reactive meter.

Steam Turbine Progress in England

The development of the steam turbine during the past few years has been very rapid, and al-

though more large units have probably been built in this country than in Europe we should not forget the pioneer work of British engineers or overlook the fact that much attention has recently been paid to the improvement of the steam turbine by European manufacturers.

Some of the earliest machines designed by Sir Charles Parsons were in operation at the Glasgow exposition in 1888. These were small units running at about 10,000 r.p.m. Engineers at that time were skeptical and inclined to make fun of the little "steam-eaters" as these earlier designs were referred to, not without good reason. These machines were placed side by side with the monster slow-speed engines of the vertical marine type, standing sometimes 40 ft. above the bed plate, and the Clydeside engineers of those days were not prepared to recognize the tiny high-speed turbines as serious competitors in the field of steam engineering.

The De Laval turbine was the first steam turbine of the impulse type which may correctly be referred to as a practical machine, but credit should be given to Parsons who was responsible for the development of the modern steam turbine on the reaction principle. In 1899 machines of 1000-kw. capacity were being built, and in 1913 the first 25,000-kw. Parsons turbine was sent to Chicago. In 1902 the 200-hp. Parsons turbo-generator consumed 27 lbs. of steam per kw-hr., while the consumption of the large 1913 machine was only 11.25 lbs.—a figure which has been lowered only very slightly during recent years.

In 1910 the combined Curtis-Parsons turbine was introduced by Brown, Boverie & Co. It is built as a single-cylinder unit in every case, and has become the standard with this firm.

A good summary of the development of the steam turbine, not only in Europe, but in America also is given in the paper by K. Baumann which was recently read before the (British) Institution of Electrical Engineers. This paper, written by an expert, will probably prove a landmark in the development of the steam turbine, and it should be read by all interested in this subject. Mr. Baumann points out that although machines for an output of 50,000 kw. at 1000 r.p.m. have been built they are very costly, and future progress will be toward increasing the output of 1500 r.p.m. machines. The largest units at present in operation at 1500 r.p.m. are for an output of 35,000 kw. maximum continuous rating. The d-c. generator coupled directly to the turbine, except for machines of a quite moderate capacity, has practically disappeared from the market, its place having been taken by lower-speed generators driven by mechanical reduction gear. Great improvements have recently been made in these mechanical reduction gears, and d-c. units operated in this manner are now built for outputs of 4000 kw. The improvement in reduction gears is also responsible for considerable changes in engineering practice with regard to the smaller units. It is not improbable that we shall soon see the 1000-kw., 3000 r.p.m. turbogenerator replaced by a turbine running at high speed and coupled through reducing gear to a medium-speed alternator.

A comparison of the commercial development of impulse and reaction turbines shows that prior to the war the position in the European countries was approximately 30 makers and 900 turbines, totalling an output of 1,400,000 kw.—all of the impulse type. Of the reaction type there were only nine makers, with 250 turbines, and a total output of 500,000 kw.

In the matter of steam pressures 350 lb. per sq. in. has been adopted with temperatures as high as 750 deg. F., but 700 deg. F. is the present standard. A vacuum of 29.1 in. is now obtainable.

The development of the steam turbine in Europe has been in the direction of increasing the diameter as far as possible and so reducing the number of stages. This is exactly contrary to the tendency in this country, where small diameters have been adopted with a large number of stages.

During the last 9 or 10 yrs. improvements in design of steam turbines have resulted in a reduction of floor space occupied from about 40 to less than 20 sq. ft. for turbines of 1000 kw. output, the weight being also approximately halved, namely from 14 to 7 tons.

In the case of turbo-alternator sets of large size the floor space occupied has been reduced from 60 to below 40 sq. ft. per 1000 kw., and the weight from over 20 to below 15 tons per 1000 kw. Present practice would seem to indicate that the weight of the smaller higher-speed units is about 10% less per kw. capacity than that of the large lower-speed units. The cost per kilowatt is, however, about 10% higher for the small than for the large steam turbines. The use of oil relays for the operation of the governor valve is now practically universal for all large units.

In getting electrical devices introduced into buildings, the architect must look to the manufacturer for the co-operation necessary to standardize the use of such devices. Further educational work must be along the lines of showing the owner and architect that electrical contracts should not be awarded solely on price, but upon the responsibility of the contractor to perform his duty in living up to the specifications. While the manufacturer's obligation ceases with the production of his materials, he is dependent upon the contractor to properly install the apparatus.

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

PERSONNEL OF VARIOUS N. E. L. A. COMMITTEES.

President Bump Appoints Chairmen of Special and General National Committees—Public Relations National Section Committees Named.

In addition to appointments of committee chairmen announced on p. 209, ELECTRICAL REVIEW, Aug. 6, 1921, President M. R. Bump, National Electric Light Association, has made the following appointments of chairmen of special national committees: National Counselor to the United States Chamber of Commerce, and National Representative upon the National Industrial Conference Board, John W. Lieb, New York Edison Co., New York City; Finance Committee, Joseph B. McCall, The Philadelphia Electric Co., Philadelphia; Water Power Development Committee, Franklin T. Griffith, Portland Railway Light & Power Co., Portland, Ore.; Electrical Resources of the Nation, M. S. Sloan, Brooklyn Edison Co., Inc., Brooklyn, N. Y.; Lamp Committee, Frank W. Smith, The United Electric Light & Power Co., New York City; Wiring Committee, R. S. Hale, The Edison Electric Illuminating Co. of Boston; Insurance Committee, S. E. Wolff, Hodenpyl Hardy & Co., New York City; Constitution and By-laws, W. C. L. Eglin, The Philadelphia Electric Co., Philadelphia, and Doherty and Billings Prizes, A. S. Loizeaux, Consolidated Gas, Electric Light & Power Co., Baltimore.

The following have been appointed by President Bump as chairmen of general national committees: Accident Prevention Committee, Charles B. Scott, Bureau of Safety, Chicago; Company Employes Organizations Committee, R. B. Grove, United Electric Light & Power Co., New York City, and Membership Committee, Walter Neumuller, The New York Edison Co., New York City.

The second meeting of the National Executive Committee, including the chairmen of committees named above, will be held at National headquarters on Thursday, Sept. 1, to consider the National Electric Light Association program for the year and to take up important matters including the approval of budgets for divisional, sectional, committee and headquarters' activities.

WOMAN'S COMMITTEE ON PUBLIC INFORMATION APPOINTED.

A feature of the work of the Public Relations National Section during the coming year will be the educational work carried on with the assistance of the women of the industry, and the women of the country, as shown by the appointment of a Woman's Committee on Public Information, just announced by Chairman Martin J. Insull of that section. This committee will be headed by Miss S. M. Sheridan, Detroit Edison Co., the other members of the committee being: Miss B. H. Lowrie, H. L. Doherty & Co., New York City; Miss O. A. Bursiel, 149 Tremont street, Boston; Miss C. H. Zillesson, Philadelphia Electric Co., Philadelphia, and Miss R. E. McKee, Middle West Utilities Co., Chicago.

Two other new committees are included in the organization of the Public Relations National Section. These are the Committee on Employe Relations with the Public and a Committee on Public Speaking.

PERSONNEL OF PUBLIC RELATIONS NATIONAL SECTION COMMITTEES.

The complete committee personnel in addition to the Woman's Committee on Public Information as announced by Chairman Insull follows: Committee on Employe Relations with the Public—H. C. Blackwell, chairman, Kansas City Power & Light Co., Kansas City, Mo.; R. F. Pack, Northern States Power Co., Minneapolis; J. E. Davidson, Nebraska Power Co., Omaha, Neb.; S. M. Kennedy, Southern California Edison Co., Los Angeles; A. Hardgrave, American Public Service Co., Dallas, Tex., and Frank W. Smith, United Electric Light & Power Co., New York City. Committee on Public Speaking—H. C. Couch, chairman, The Pine Bluff Co., Pine Bluff, Ark.; Donald MacDonald, Louisville Gas & Electric Co., Louisville, Ky.; George R. Jones, Public Service Co. of Northern Illinois, Chicago; George L. Myers, Pacific Power & Light Co., Portland, Ore.; Dudley Farrand, Public Service Electric Co., Newark, N. J., and P. S. Arkwright, Georgia Railway & Power Co., Atlanta, Ga. State Organization of Public Utility Information Committee—H. T. Sands, chairman, Charles N. Tenney & Co., Boston; C. H. Bell, Kansas City Power & Light Co., Kansas City, Mo.; J. F. Gilchrist, Commonwealth Edison Co., Chicago; Harry Reid, Kentucky Utilities Co., Louisville, Ky., and Robert Lindsay, Cleveland Electric Illuminating Co., Cleveland. Uniformity of State Regulatory Laws Committee—W. W. Freeman, chairman, Union Gas & Electric Co., Cincinnati; Gordon G. Brownell, H. L. Doherty & Co., New York City; Luther R. Nash, Stone & Webster, Boston; F. B. Odlum, Electric Bond & Share Co., New York City; Judge J. M. Roemer, H. M. Byllesby & Co., Chicago; R. D. Stevenson, Middle West Utilities Co., Chicago; R. H. Ballard, Southern California Edison Co., Los Angeles, and Thomas W. Martin, Alabama Power Co., Birmingham, Ala. Relations with Bankers Committee—M. S. Sloan, chairman, Brooklyn Edison Co., Inc., Brooklyn, N. Y.; J. F. Owens, Oklahoma Gas & Electric Co., Oklahoma City, Okla.; M. E. Sampsell, Central Illinois Public Service Co., Chicago; A. F. Hockenbeamer, Pacific Gas & Electric Co., San Francisco; W. H. McGrath, Puget Sound Power & Light Co., Seattle, and W. C. Sterne, Summit County Power Co., Denver, Colo. Upbuilding

the Industry Committee—F. R. Coates, chairman, Toledo Railways & Light Co., Toledo, O.; E. W. Rockafellow, Western Electric Co., New York City; W. E. Robertson, Robertson-Cataract Electric Co., Buffalo, N. Y.; A. Emory Wishon, San Joaquin Light & Power Corp., Fresno, Cal ; E. W. Lloyd, Commonwealth Edison Co., Chicago, and H. C. Blackwell, Kansas City Power & Light Co., Kansas City, Mo. Manufacturers' Advertising Committee—P. L. Thomson, chairman, Western Electric Co., New York City; F. H. Gale, General Electric Co., Schenectady, N. Y.; L. D. Gibbs, Edison Electric Illuminating Co. of Boston; H. E. Hoover, Hoover Suction Sweeper Co., North Canton, O.; Neil C. Hurley, Hurley Machine Co., New York City; J. F. Killeen, Edison Electric Appliance Co., New York City; C. F. Kineman, Sterling Bronze Co., New York City; J. C. McQuiston, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.; John Mustard, Wagner Electric Manufacturing Co., Philadelphia; J. W. Perry, H. W. Johns-Manville Co., New York City; Carl H. Reed, Electric Storage Battery Co., Philadelphia; E. B. Seitz, American Washing Machine Manufacturers Association, Chicago, and P. B. Zimmerman, National Lamp Works of General Electric Co., Cleveland.

To facilitate attendance by Western members, the Executive Committee of the Accounting National Section will hold its next meeting at Glenwood Springs, Colo., Sept. 20. This date has been fixed in order to take advantage of the convening of accountants from the Middle West and Rocky Mountain Sections at the annual convention of the Rocky Mountain Geographic Division, which will be held Sept. 19-21.

LIGHTING OF CLOTHING FACTORIES TO BE DISCUSSED.

Application of Illuminating Engineering Principles in Merchandising Among Subjects Listed on Program for I. E. S. Meeting.

The tentative program prepared for the 15th annual convention of the Illuminating Engineering Society, to be held at Rochester, N. Y., during the week of Sept. 26, contains many valuable papers and addresses on lighting problems, in addition to the usual interesting reports of the various officers and committees. A list of the papers and speakers is presented herewith:

Monday, Sept. 26, 2:15 *p. m.*—Presidential address by Gen. Goerge H. Harries; report of Council by Clarence L. Law; reports on "The Past Year's Progress in Illuminating Engineering," by F. E. Cady, chairman of the Committee on Progress; "Further Standardization of Nomenclature" by A. E. Kennelly, chairman of the Committee on Nomenclature and Standards, and "Code of Lighting Factories, Mills and Other Work Places" by L. B. Marks, chairman of the Committee on Lighting Legislation.

Tuesday, Sept. 27, 9:30 *a. m.*—Paper on "Effects of Radiation on the Eye" by Louis Bell and F. H. Verhoeff; "The Effect of Variations of Visual Angle and Intensity and Composition of Light on Important Ocular Functions" by C. E. Ferres and Gertrude Rand; "Speed, Accuracy and Constancy of Visual Response as Influenced by Distributions of Brightnesses" by H. M. Johnson, and "Eye Fatigue in Industry" by Max Poser.

Tuesday, Sept. 27, 2:15 *p. m.*—Papers on "The Quality of Light and the Brightness of Various Illuminants as Determined from Their Color Temperature" by E. P. Hyde and W. E. Forsythe; "Sky Brightness and Daylight Illumination Measurements" by H. H. Kimball, chairman of the Committee on Sky Brightness; "A Low-Voltage, Self-Starting Neon-Tungsten Arc-Incandescent Lamp" by D. McFarlan Moore; "Incandescent Lamp Temperatures as Related to Modern Lighting Practice" by Chester L. Dows, and "The Code of Fixture Design and Installation" by M. Luckiesh, chairman of the Committee to Cooperate With Fixture Manufacturers.

Tuesday, Sept. 27, 8:15 *p. m.*—Papers on "Animal Light" by E. Newton Harvey, and "Luminescence as a Factor in Artificial Lighting" by E. L. Nichols.

Wednesday, Sept. 28, 9:15 *a. m.*—Papers on "A Determination by Various Drivers of the Desired Road Illumination from Automobile Headlamps" by H. H. Magdsick and R. N. Falge; "Motor Vehicle Headlighting in Massachusetts" by A. W. Devine; "The Theory of the Flicker Photometer" and "Paints for Integrating Spheres" by A. H. Taylor, and "Interlaboratory Photometric Measurements of Gas-Filled Tungsten Lamps" by F. E. Cady and W. E. Forsythe.

Thursday, Sept. 29, 9:15 *a. m.*—Papers on "Illuminating Engineering Factors in Electric Sign Design" by C. A. Atherton; "Illumination and Traffic Accidents—Statistics from 32 Cities" by E. A. Anderson and O. F. Haas, and "Application of Illuminating Engineering Principles in Merchandising" by W. L. Goodwin.

Thursday, Sept. 29, 2:15 *p. m.*—Paper on "The Lighting of Clothing Factories" by A. B. Oday and R. W. Peden; closing formalities and induction of president-elect, Dr. George S. Crampton, Philadelphia.

MICHIGAN ASSOCIATION TO MEET AT OTTAWA BEACH.

Public Relations, Rural Line Extensions and Safe Wiring Among Important Subjects to Be Discussed at M. E. L. A. Meeting.

More than 200 representatives of the electric light and power interests of Michigan will gather at the Ottawa Beach hotel at Black Lake, Tuesday, Aug. 23, for the 3-day annual convention of the Michigan Electric Light Association. Among the speakers scheduled on the program for the meeting are Hon. W. W. Potter, of the Michigan Public Utilities Commission; Alex Dow, president of the Detroit Edison Co.; President M. R. Bump and Executive Manager M. H. Aylesworth of the National Electric Light Association; W. L. Goodwin, general manager of the Society for Electrical Development, and Attorney James V. Oxtoby, Detroit.

The 1921 convention of the Michigan Association will differ from others in that much of the technical discussion will be eliminated and special emphasis will be put upon matters having to do with public relationship. The convention will open Tuesday afternoon with a meeting of the Executive Committee, and Tuesday evening there will be a showing of the new motion picture reel produced by the National Electric Light Association.

The formal opening will be Wednesday morning when President George E. Lewis, who is also mayor of the city of Ann Arbor, will give the opening address. He will be followed by Messrs. Bump, Aylesworth and Goodwin. Mr. Goodwin, as representative of the Society for Electrical Development, will be one of the features of the program. He is a strong, forceful speaker with a comprehensive knowledge of his subject and he will make an eloquent appeal for closer co-operation between electrical contractors and the central station. A special invitation is made to all elec-

trical contractors to attend the convention and take part in all its activities. While the masculine contingent is attending to business in the forenoon, the ladies will engage in a card tournament on the veranda of the hotel.

Afternoons are to be given over to social and athletic activities. Tuesday afternoon will be devoted to the annual golf tourney for both men and women. At 5 p. m. the committee on entertainment will stage its annual lawn sports that have come to be one of the most attractive amusement features of the convention.

The annual banquet will take place at 7 p. m. Wednesday. The program has been made short and snappy with only one speaker, Alex Dow, of the Detroit Edison Co., who is expected to take a leaf from his book of experience in successful public relationship and tell the electric light and power men what is needed to promote a better and more sympathetic attitude on the part of the public.

Thursday morning will feature talks by Commissioner Potter and Attorney James V. Oxtoby. There will also be a report on the work of the new Committee on Public Utility Information, the report of Chairman Eugene Holcomb of the new Committee on Overhead Lines, which is working out a code for rural line extensions, and the report of the Committee on Safe Wiring by Chairman J. C. Langdell. The annual election will follow this session.

VOTE AGAINST BUYING UTILITIES IN SPRINGFIELD.

The referendum election in Springfield, Ill., Aug. 16, apparently resulted in a victory for the program of the city commission and against the proposal to purchase the light and heat facilities of the Springfield Gas & Electric Co. The commission's plan is to develop the city light plant, and bonds for this purpose are to be issued to the amount of $400,000.

The Springfield Gas & Electric Co., furnishing three-fourths of the city's power and steam heat, lost its franchise by expiration Aug. 15. The franchise under which the company operated the street cars and gas works of the city does not expire for several years. The company has tried repeatedly to secure exclusive franchises. It did not want the municipal plant to be enlarged and otherwise put in a position to compete for the business of the citizens. The city offered a 25-yr. franchise to the concern Aug. 12 and the company accepted, thereby averting a threatened industrial suspension that had alarmed the residents of Springfield.

ELECTRICAL CO-OPERATIVE LEAGUE PLANS ACTIVE CAMPAIGN.

Standardized Service and Co-operative Advertising to Promote Use of Electricity Discussed by Denver Organization.

An active campaign for the betterment of the electrical industry in Denver was launched Aug. 4 by the Electrical Co-operative League of that city. Laurence W. Davis, special representative of the National Association of Electrical Contractors and Dealers, was the speaker at the dinner and the meeting was attended by 150 electrical men. The soireé, as it was called, was arranged by the Electrical Co-operative League, the newly-formed electrical development organization of the "Mile High" city. The League secured the services of Mr. Davis for the month of August, and as a starter had him outline the campaign and explain the value of the work which will be carried on.

Announcement was made at the banquet of the League's plans for constructing and exhibiting a modern electrical home in the near future. It is reported that the preliminary publicity secured from this announcement has created considerable interest already, judging from the number of inquiries made at the League's headquarters. Standardized service of a co-operative nature was strongly urged, as was more widespread co-operative advertising, with a view to educating the public as to the economy and use of electricity. Announcement was made by Mr. Davis of the coining of the word "electragist" and its use in lieu of the generic classification of the words "electrical contractor-dealer."

Meetings of the smaller groups represented in the Denver League were scheduled and, following the plan of bringing the subject to the atten-

Members of Electrical Co-operative League of Denver at Their Recent "Get-Together" Dinner.

tion of the general public, arrangements were made for Mr. Davis to appear before the Lions, Kiwanis and Rotary Clubs and similar commercial and civic organizations. T. O. Kennedy, chairman of the League Advisory Committee, presided at the dinner. The committee in charge was J. W. Ryall and Clarence Keeler, assisted by Sidney W. Bishop, the executive manager.

REVIEW OF BUILDING OPERATIONS IN JULY.

Building Contracts in Central West Showed Decrease of 5% From June Figures—Northwest Contracts for July Increased 30%.

Construction activity in July, according to figures published by the F. W. Dodge Co., was 7% less than in June, although it was 4% greater than in July, 1920. Contracts awarded during the month of July in 27 Northeastern states of the country amounted to $212,491,000. Although the increases in building operations which were expected to develop in the summer months have not materialized, construction activity has held up very well in comparison with other lines of business. During the first 10 days of July the volume of building contracts was very low, while the last three weeks showed total figures of considerable magnitude. Discussions of wage scales in many centers have been protracted and settlements have been delayed. Confidence in the stability of construction costs has not yet been generally established, although it is the opinion of a number of reliable authorities that necessary construction enterprises may be undertaken now under as favorable conditions are are likely to prevail at any time in the near future.

The total volume of building contracts let in the territory covered by the Dodge company during the first 7 mo. of the present year has amounted to $1,278,747,000, which is 10% greater than the average figure for the first 7 mos. of the preceding 5 yrs. Residential building continued in the lead over all other classes in July, amounting to $60,452,000, or 28% of the total. Public works and utilities amounted to $46,902,000, or 22% of the total; business buildings, to $33,240,000, or 16%; educational buildings, to $28,602,000, or 13%; and industrial buildings, to $13,604,000, or 6½%. Contemplated new work reported from Jan. 1 to Aug. 1, 1921, has amounted to $2,838,000,000, more than double the volume of contracts awarded in the same period.

In the New England states July building contracts amounted to $20,823,000, an increase of 28% over the June figure. Included in the July total were the following items: $7,058,000, or 43%, for residential buildings; $5,296,000, or 25%, for educational buildings; $2,231,000, or 11%, for public works and utilities; and $2,174,000, or 10%, for business buildngs. Total construction contracts let in this district during the first 7 mo. of this year have amounted to $102,242,000, which is 20% less than the average for the first 7 mo. of the preceding 5 yrs. Contemplated new work was reported during July in New England to the amount of $29,965,000, which was 55% greater than the amount of contemplated work reported in June.

Contracts awarded during July in New York state and Northern New Jersey amounted to $52,976,000, a decrease of 15% from the June figure. The July total included the following items: $22,161,000, or 42%, for residential buildings; $11,006,000, or 21%, for business buildings; $5,317,000, or 10%, for public works and utilities; and $4,789,000, or 9%, for educational buildings. Total construction contracts let in this district during the first 7 mo. of 1921 have amounted to $297,228,000, an increase of 15% over the average for the first 7 mo. of the preceding 5 yrs. Contemplated new work reported in this district in July, 1921, amounted to $74,290,000, bringing the total amount of projected work reported from Jan. 1 to Aug. 1 up to $756,844,000, which is more than two and a half times the amount of contracts awarded in the same period.

July building contracts in the middle Atlantic states (comprising southern New Jersey, eastern Pennsylvania, Delaware, Maryland, the District of Columbia, Virginia, and North and South Carolina) amounted to $26,342,000, a decrease of 18% from the June figure. The July total was divided as follows: $7,362,000, or 28%, for public works and utilities; $7,170,000, or 27%, for residential buildings; $4,356,000, or 17%, for business buildings; and $2,570,000, or 10%, for educational buildings. From Jan. 1 to Aug. 1, 1921, the total value of contracts let in this district has amounted to $186,675,000, which is practically equal to the average for the first 7 mo. of the preceding 5 yrs. During July, 1921, contemplated new work in this district was reported to the amount of $38,765,000, bringing the total amount of contemplated work reported since the first of January up to $438,723,000, nearly two and a half times the volume of contracts awarded in the same period.

July building contracts in western Pennsylvania, West Virginia, Ohio, Kentucky and Tennessee amounted to $43,021,000, a decrease of 9% from the June figure. Included in the July total were the following items: $15,306,000, or 35%, for public works and utilities; $10,192,000, or 24%, for residential buildings; $5,021,000, or 12%, for educational buildings; and $4,226,000, or 10%, for business buildings. The total amount of contracts awarded from Jan. 1 to Aug. 1, 1921, in this district has amounted to $258,589,000, an increase of 25% over the average for the first 7 mo. of the preceding 5 yrs. In July, 1921, contemplated new work was reported in this district to the amount of $68,600,000, which was 29% greater than the amount of contemplated work reported in June.

July building contracts in the Central West (comprising Illinois, Indiana, Iowa, Michigan, Wisconsin, Missouri and portions of Eastern Kansas and Nebraska) amounted to $58,244,000, a decrease of 5% from the June figure. Included in the July total were the following: $13,162,000, or 23%, for public works and utilities; $10,540,000, or 18%, for business buildings; $10,495,000, or 18%, for residential buildings; and $8,570,000, or 15%, for educational buildings. During the first 7 mo. of this year contracts were let in this district to the amount of $384,173,000, which is practically equal to the average for the first 7 mo. of the preceding 5 yrs. Dur-

ing July the amount of contemplated new work reported in this district was $98,772,000. The total volume of contemplated new work reported in the first 7 mo. of the year has amounted to $889,081,000, which is more than double the value of contracts awarded in the same period.

Contracts awarded in July in Minnesota and North and South Dakota amounted to $11,084,000, an increase of 30% over the June figure. Included in the July total were: $3,524,000, or 32%, for public works and utilities; $3,376,000, or 30%, for residential buildings; and $2,355,000, or 21%, for educational buildings. Contracts awarded in this district during the first 7 mos. of this year have amounted to $49,839,000, an increase of 30%, over the average for the first 7 mo. of the preceding 5 yrs. Contemplated new work reported during July, 1921, in this district amounted to $17,273,000, which was 6% greater than the amount of projected work reported in June.

TRADE CONDITIONS IN NORTHWEST FAIRLY GOOD.

Prospects in Electrical Supply and Appliance Business Promising—Pacific Coast Division of Jobbers' Association to Meet.

The Pacific Coast Division of the Electrical Supply Jobbers' Association will meet in annual convention at Paradise Inn, Rainier National Park, 40 mi. from Seattle, Aug. 29-31. The membership comprises the electrical jobbers of California, Oregon and Washington.

The prospect of autumn business in electrical appliances and material for electrical construction in the Pacific Northwest is fairly good, according to a consensus of opinion expressed among jobbers and dealers. Especially does the country town trade seem rather promising, resulting from building construction. In the cities the building operations are comparatively light, those in Portland being considered rather the best.

The best trade, present and prospective, seems to be for farm-lighting and power units, requiring gasoline-engine driven generators and storage batteries. This business is mostly in localities not reached by the central-station power lines, and is especially good in the well-improved farming valleys, such as the Willamette valley in Oregon and in the Yakima, Columbia and Walla Walla valleys of Washington. The electric power companies, while not extending many power lines to take care of farm and orchard consumers, are considering the matter of taking it up more extensively in the future.

The electric range business in the cities and larger towns is holding up well, as is also that of other household appliances. Domestic appliances, with the exception of vacuum cleaners, are selling at prices about 10% lower than those of last year.

Sales of material for power-line construction do not indicate much activity in line extensions by the power companies.

Better sales conditions undoubtedly prevail in California than in the Northwest, although building operations in San Francisco are held back by unsettled wage conditions. The irrigated farming areas of that state no doubt have the most satisfactory trade conditions, and this is reflected in appliance sales and demands for pumping equipment.

Storage battery sales for equipment in the fishing and fish-canning industry have been very good, and those metal mines and coal mines which are in operation in Idaho, Montana and Alaska have kept up some demand for that class of equipment in connection with underground haulage.

ELECTRICAL APPLIANCE SALESMANSHIP CLASSES.

Northwest Electric Service League Inaugurates Course of Instruction to Develop Methods of Selling as Service to Public.

A course in electrical salesmanship, given at Seattle under the auspices of the Northwest Electric Service League, aims to develop methods of selling as a service to the buyer and to the public. The course of instruction, conducted by Stephen I. Miller, manager of the League, began Aug. 16 and will continue 10 wks., holding two sessions a week. There was at the beginning an enrollment of 50, which may be reduced to about 25. The class is made up largely of electrical appliance salesmen who desire better training, and new aspirants without much previous experience.

The course embodies the consideration of all the elements of the sales business, including the salesman, the goods, the buyer, and such essentials as attention and interest, appeal and desire, decision and action, and confidence. Part of the class procedure will take the form of round-table discussions, with some sales demonstrations of appliances in which their mechanism will be made clear.

Mr. Miller's plan is to develop an appreciation of the fact that goods should be sold on quality rather than on price, as the most effective way of meeting irresponsible competition. The purpose of the League, it is understood, is to conduct similar classes in other cities of the Northwest.

INDUSTRIAL ADVERTISING CHIEFS PLAN IDEA BUREAU.

Engineering Advertisers and Technical Publicity Associations Arrange Joint Program for 1922 Meeting of the A. A. C. W.

While the Associated Advertising Clubs of the World was in convention in Atlanta recently, a representative of the Engineering Advertisers Association called an informal meeting of industrial advertising managers. Many at this conference voiced the need of a national organization of some kind, primarily as an idea exchange for advertising managers having to do with the movement of goods from industry to industry.

It was the consensus of opinion that the Engineering Advertisers Association and the Technical Publicity Association jointly arrange a program for the next convention of the Advertising Clubs of the World in Milwaukee in 1922. On June 10, this year, the Board of Directors of the Engineering Advertisers Association passed a resolution inviting the Technical Publicity Association to join in the preparation of an industrial

program in connection with the Milwaukee convention, this feature at present being unrepresented in the Associated Advertising Clubs of the World. It is then planned to develop a national organization for the improvement of methods of marketing as pertaining to the movement of goods from one industry to another.

Leaders in their field will be on the program, presenting their best thoughts on such subjects as "The Organization of an Industrial Advertising Department," "Direct Advertising and the Movement of Goods from Industry to Industry," "The Business Press" and "Technical Copy."

RULING ON USE OF ADVERTISING "KEYS" IN PERIODICALS.

ELECTRICAL REVIEW and other publications are in receipt of Circular No. 37 from the U. S. Post Office at Chicago, containing a ruling in reference to the use of "Key" addresses to advertisements. The communication follows:

To the Publisher:—
Re-Advertisements—Street and Post Office Address.
My dear Sir:—

Your attention is respectfully invited to the following ruling of the Department with reference to the use of key numbers and without street and post office address in advertisements in newspapers and periodicals:

> "In reply to your letter of the 5th instant I have to say that replies addressed in accordance with instructions in advertisements appearing in newspapers, magazines, etc., which show merely a 'key' number and the words 'Chicago, Illinois,' as the post office address of the advertisement would not be mailable, as under the provisions of Section 479, Postal Laws and Regulations, matter which is insufficiently addressed is unmailable. All advertisements appearing in newspapers, magazines, etc., soliciting replies by mail should give not only the name of the advertiser but also his street and post office address."

Any action you may take in this direction that will tend to reduce the number of letters, papers, etc., addressed without street and number, that are received for delivery in this city, will be appreciated.

DOUGLAS FIR SPECIFIED FOR PIPE LINE IN VERMONT.

The New England Power Co. will use 4 mi. of 8.5-ft. continuous stave wood pipe in a new hydroelectric development project planned in Vermont. In letting the contract to the Continental Pipe Manufacturing Co., Seattle, the New England Power Co. specified Douglas fir because of its satisfactory performance in former New England installations. It is stated that 91 freight cars will be required to haul the lumber for this pipe from Washington to Vermont.

REDUCTION IN UTILITY RATES.

According to reports from Oklahoma City, Okla., three public utilities have recently made voluntary reductions in their rates. The Public Service Co. of Oklahoma reduced basic rates on electricity at Guthrie from $0.15 per kw-hr. to $0.12, with the scale ranging downward according to quantity used, to as low as $0.06. The Henryetta (Okla.) Electric Light Co. reduced its rate from $0.13 to $0.11, graduated downward as larger quantities are used. The action was approved by the Oklahoma Corporation Commission, the new rates being effective Aug. 1.

COMING CONVENTIONS.

Michigan Electric Light Association. Annual convention, Ottawa Beach, Mich., Aug. 24-25. Headquarters, Hotel Ottawa. Secretary, Herbert Silvester, Ann Arbor, Mich.

Pacific Coast Division of the Electrical Supply Jobbers' Association. Annual convention, Paradise Inn, Rainier National Park, Wash., Aug. 29-31.

First National Radio Exposition, Broadway Armory, 5875 Broadway, Chicago, Aug. 30-Sept. 3, under auspices of the American Radio Relay League. Show derector, N. E. Wunderlich, 4533 North Sawyer avenue, Chicago.

New England Geographic Division of the National Electric Light Association. Annual convention, New London, Conn., Sept. 6-9. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, 149 Tremont street, Boston.

International Association of Municipal Electricians. Annual convention, Colorado Springs, Colo., Sept. 6-10. Secretary, Clarence R. George, Houston, Tex.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., Sept. 7-10. Secretary, Henry M. Stine, 211 Locust street, Harrisburg, Pa.

National Exposition of Chemical Industries, Eighth Coast Artillery Armory, New York City, Sept. 12. Secretary, Charles L. Parsons, 1709 G street, N. W., Washington, D. C.

Great Lakes Geographic Division of the National Electric Light Association. Annual convention, French Lick Springs, Ind., Sept. 14-16. Secretary, R. V. Prather, 305 De Witt Smith building, Springfield, Ill.

Indiana Electric Light Association. Annual convention, French Lick Springs, Ind., Sept. 14-16.

Rocky Mountain Geographic Division of the National Electric Light Association and the Colorado Electric Light, Power and Railway Association. Joint annual convention, Glenwood Springs, Colo., Sept. 19-21. Headquarters, Hotel Colorado. Secretary, Minnie B. W. Baker, 900 Fifteenth street, Denver, Colo.

Association of Iron and Steel Electrical Engineers. Fifteenth annual convention, Chicago, Sept. 19-24. Headquarters, Hotel La Salle. Secretary, John F. Kelly, Empire building, Pittsburgh.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers. Annual convention, Huntington, W. Va., Sept. 20-22. Secretary, Herbert Smith, 212 Robson-Pritchard building, Huntington, W. Va.

Illuminating Engineering Society. Annual convention, Rochester, N. Y., Sept. 26-29. Headquarters, Powers hotel. General secretary, Clarence L. Law, 29 West 39th street, New York City.

American Electrochemical Society. Meeting at Lake Placid Club, N. Y., Sept. 29-Oct. 1.

New York Electrical Show, 71st Regiment Armory, Park avenue and 34th street, New York City, Sept. 28-Oct. 8. General manager, George F. Parker, 124 West 42d street, New York City.

Cleveland Section of the American Society of Mechanical Engineers. Great Lakes regional meeting, Cleveland, Oct. 3-4. James Guthrie, Fidelity building, Cleveland.

Indiana State Association of Electrical Contractors and Dealers. Annual convention, Indianapolis, Oct. 5-6. Headquarters, Claypool hotel. Secretary, A. I. Clifford, 507 Odd Fellows building, Indianapolis.

Indianapolis Industrial Exposition, Indiana State Fair Grounds, Oct. 10-15, under auspices of the Indianapolis Chamber of Commerce. Chairman, O. B. Iles, Chamber of Commerce building, Indianapolis.

Southeastern Geographic Division of the National Electric Light Association. Annual convention, Chattanooga, Tenn., Oct. 18-20. Headquarters, Signal Mountain Inn. Secretary, Charles A. Collier, Electric and Gas building, Atlanta, Ga.

National Council of Lighting Fixture Manufacturers. Annual convention and Lighting Fixture Market, Auditorium, Milwaukee, Jan. 30-Feb. 4. Secretary, Charles H. Hofrichter, 231 Gordon Square building, Cleveland.

COMMERCIAL PRACTICE

New Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

OKLAHOMA COMPANY RENEWS "AD" WRITING CONTESTS.

J. F. Owens, vice-president and general manager of the Oklahoma Gas & Electric Co., has announced that last year's prize contest among the students of the School of Journalism, University of Oklahoma, for the best advertisements and feature stories regarding public utility companies will be made a permanent institution. Five prizes of $5 each for the best monthly offerings and a grand prize of $50 will be awarded each year.

ACHIEVEMENTS OF UTILITY STOCK SELLING CAMPAIGN.

Human-Interest Features Described by Official of Southern California Edison Co. in Sale of Its Securities to the People.

Twenty-four thousand individuals in Southern California are now owners of the stocks and bonds of the Southern California Edison Co., and subscriptions at the rate of over 100 a day to the stock of the company are coming in by every mail. "If our stock and bondholders were grouped," said Vice-President A. N. Kemp, in charge of the financing of the company, as he analyzed and chatted about the foregoing statement, "we would have a city of 120,000 inhabitants, all of whom would be represented in the ownership of the securities of the company. This 'Edison City' would be much larger than Los Angeles was at the time the old Edison Electric Co. began its operations, and its gradual and constructive growth. I reach this conclusion by the standard form of allowing five members to a family, of course assuming that only one member of the family is a holder of either stocks or bonds. As there are over 24,000 Southern California holders of our securities, you see that I have a margin to offset duplicated holdings in one family."

On June 24 the company completed the fifth month of its new stock-ownership campaign, at which time it had sold $7,985,000 par value of its common stock. This sets a record for the sale of utility stock to individual buyers. In 1917 when the company began offering its stock to its consumers and the people of California, it had a total of 1864 stockholders. It now has 17,500 stockholders. Included in this figure are 2955 employes, out of a total permanent payroll of 3500. The number of the company's local stockholders is increasing daily, the record seeming to indicate that the idea of consumer-ownership is growing of its own momentum and that one stockholder brings one or two more.

"Over our stock sales counter," said Mr. Kemp, "come some very unique human interest stories. Of course, our salesmen never ask any questions, but people who feel that they are buying a partnership interest in the electric utility which serves them often tell us of their own affairs and the reasons why they want to become partners.

"A few days ago a neat appearing little lady who said she was a salesgirl in one of the stores in our shopping district came in and bought one share of stock on our savings plan, paying $5 down and agreeing to pay $5 per mo., which would give her a paid up certificate at the end of 18 mo. This little lady lives in an apartment house—one of those where each tenant has an individual meter. She has an electric grill on which she does most of her cooking, an electric percolator, an electric flatiron, and I presume an electric curling iron. Her service bill never exceeds the minimum charge fixed by the Los Angeles city ordinance. This wise young lady figured it out for herself that by buying one share of Edison common stock that the dividends would come within a few cents a month of paying for her cooking, ironing and hair curling. By her little saving of $5 per mo. she will soon accomplish her desire and will, in fact, own all of the great hydroelectric resource of the state of California that she requires for her own modest individual use. And she makes her investment on the same basis and at the same price as any millionaire.

"This little woman can be taken as a fair type of our minimum partner. Up go the holdings of others, figured out in many instances on the basis of how much stock dividends will be required to pay their annual electric bill. Storekeepers require more than bungalow owners, and irrigators require still more, and factories require more than others, but the basic principle of consumer-ownership is always the same as with our little salesgirl.

"One of our hydroelectric engineers has figured out a rather interesting angle of consumer-ownership. He assumes that a ranchman owning 20 acres under irrigation had a waterfall on the back of his property and owned all the riparian rights in the stream, and that it had an effective head capacity of generating 15 hp. of electricity which would be about adequate for irrigation pumping on the average 20-acre ranch. His electric power bill, at rates fixed by the State Railroad Commission, would probably be about $150 per year. If he were to undertake to harness his own cataract it would cost him about $2000 to install a small turbine and small electric generator. The interest on this investment at 8% would be $160 per year, or $10 per year more than his electric power bill. The depreciation on his plant would be about 8% per year, and the life of the machinery would not exceed 15 yrs., and of course there would be expenses for lubricating oils and maintenance, and the risk of some accident which might run into very big money. The purchase of 20 shares of Edison common stock at the present cash price of

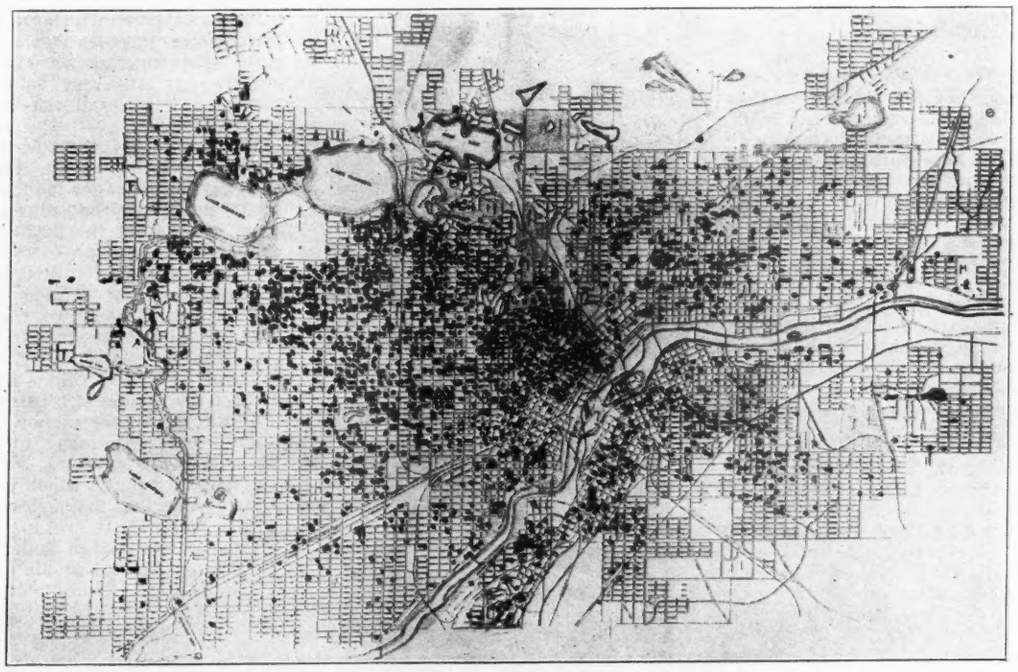
$94 per share would cost $1880 and yield him $160 per year. It thus is proven conclusively that a man can get his power several hundred dollars a year cheaper by being a partner owner in a big utility than he could develop electric power from his own private waterfall on his own stream in his own backyard."

SALES OF BYLLESBY SECURITIES WELL MAINTAINED.

Investment Department of Northern States Power Co. Shows Location of Company's Shareholders on Customer-Ownership Map.

Despite prevailing financial and industrial conditions the Byllesby utility companies have had no difficulty in beating the preferred stock sales record of the first half of last year, according to a recent report issued by H. M. Byllesby & Co., Chicago. Gross sales reported for the first 6 mo. of 1921 aggregated $3,877,000 par value, distributed in 7220 separate transactions. This is an increase of 20% in the volume of securities sold. In June, 1921, there was the usual seasonal decline in sales, but at the same time upwards of $500,000 of preferred stock was placed with the customers of the companies. The results enumerated were accomplished over a wide range of territory, including cities and towns in Minnesota, the Dakotas, Iowa, Colorado, Oregon, California, Oklahoma and Kentucky. Today the Byllesby properties have upwards of 25,000 home shareholders owning approximately $19,000,000 par value of stock.

T. C. Erringer, manager of the Investment Department, Northern States Power Co., Minneapolis division, sticks a pin in the map of Minneapolis every time his department makes a sale of stock to a customer of the company. The map, a reproduction of which appears on this page, is beginning to look like the cake dish at a picnic in the park. Eventually Mr. Erringer expects to have the map so full of pins that it will be impossible to stick another. The Northern States Power Co. has more than 16,000 shareholders. Several years ago when Mr. Erringer first began registering the location of the customer shareholders on this map there were less than 8000 shareholders of the company altogether and most of them were located outside the territory served by the company. Certain of his friends and associates laughed at his ambition—but the smile has long since faded—for customer-ownership has become an institution and practically all of the company's 16,000 shareholders today reside in territory served by the company and are customers of the company.



Map of Minneapolis Showing Location of Customer Shareholders.

OPENING FOR ELECTRICAL EQUIPMENT IN AUSTRALIA.

With the growing use of electrical equipment and appliances in Australia, involving many new schemes for the employment of electric power in place of coal for motive and railway uses, new plants for the manufacture of electrical goods are being erected. It appears that all the materials entering into such equipment are available as Australian products, and inasmuch as it is doubtful whether the recently established companies in Australia could compete with the larger American firms, it is reported that an opportunity exists for the establishment of a branch American company in Australia.

The Victorian Railway Commission, which operates the government-owned railroads of that state, is gradually electrifying the railway system of Melbourne and surrounding suburbs, the entire system being scheduled for completion by 1923 and calling for large orders of equipment.

The value of a product is not what it costs but the service it renders.

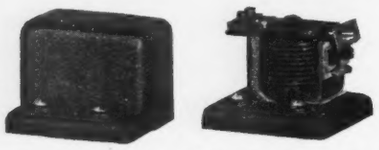
APPLIANCES and DEVELOPMENTS

New, Improved or Interesting Electrical and Mechanical Apparatus and Devices, and Applications of Equipment and Methods in Practice

New Westinghouse Cutout Relay for Automobiles.

Simplicity is the outstanding feature of the new cutout relay, or cutout, which has just been added by the Westinghouse Electric & Manufacturing Co. to its line of automotive products. The rugged construction of the device insures faithful and dependable operation throughout the life of the car.

As will be seen from the cut, the relay consists essentially of a *U* shaped strap frame, which is mounted on



External and Internal Views of New Cutout Relay.

a pressed steel base. The central core carries two windings, a shunt or voltage coil and a series or current coil. On one leg of the frame is mounted an insulated bracket which supports the stationary contact. The other leg of the frame carries the armature to which is secured the movable contact. The armature flexes on a phosphor bronze hinge and is normally held against a stop by the steel spring so that the contacts are separated. Current is carried from the movable armature to the terminal through a flexible shunt, which eliminates the usual path through a series of high resistance connections, with the liability of open circuits.

The free ends of the frame and the center core are machined to the same plane, permitting the use of flat punchings and assuring a uniform product.

The operation is as follows: When the generator voltage reaches the correct value for charging, the magnetic pull of the shunt coil overcomes the force of the spring and the armature is drawn toward the core, closing the contacts and establishing the circuit to the battery through the series or current winding. When charging is taking place the pull of the series winding is in the same direction as that of the shunt coil and is added to it, causing the contacts to be held firmly together. When the current reverses, however, and tends to flow from the battery into the generator (due to low speeds) the force of the series winding also reverses and opposes that of the shunt, neutralizing its value to such an extent that the spring forces the contacts apart and opens the circuit, preventing further discharge.

The cutout relay is undoubtedly one of the most important elements of the electrical system on the automobile. Because of its small size and almost entire freedom from trouble, its presence is hardly appreciated and its operation and the functions it performs seldom understood.

One of the simple methods used to determine if the generator is charging, is to remove the cutout cover so that the contacts are exposed and by speeding up the engine observe if they close. This should occur at engine speeds corresponding to between 5 and 10 mi. per hour in high gear. The contacts should never be pressed together with the fingers as this establishes a reverse current of high value which is sufficiently strong to overcome both the spring and shunt winding and the contacts will remain closed, permitting the battery to be rapidly discharged.

Should the contacts become badly burned or pitted they may be smoothed with a fine file until they meet squarely over the full face of the contacts. Adjustment is obtained by bending the brass stop until the cutout closes at the correct voltage; i. e., 6.5 volts for a 3-cell battery and 13 volts for a 6-cell battery. The reverse current on opening should be between 1 and 3 amperes.

A Novel Window Advertising Display Sign.

One of the novelties shown at the recent Pageant of Progress held at Chicago, was the "Mov-Ad." The device carries 24 standard car-cards mounted upon an endless chain driven by a small electric motor. The signs are held stationary opposite the opening in the front of the enameled case which incloses the mechanism for a period of 14 sec. This is ample time for a person to read the usual display sign of this size. At the end of the period a new sign is automatically shifted into position and so

"Mov-Ad" Sign in Position.

on until the entire 24 messages have been shown, when the cycle is repeated.

The sign is operated from a suitable outlet, requires very little energy and is an effective means of conveying to the passing public short talks on the merits of the goods displayed.

The operation is noiseless and the device compels attention as, if one stops to read one sign, by the time he is finished another slides into place and the natural inclination is to read the next. It requires about 6 min. for the entire 24 signs to be displayed and in this time a very effective sales talk can be put over.

Much depends upon the manner in which the signs are gotten up, brilliant color combinations and well worded messages getting and holding the attention of the reader for the entire series to pass.

The cards may be frequently changed and new thoughts passed along to the public. The "Mov-Ad" is made by the Griswold Manufacturing Co., Rock Island, Ill.

Sly Dust Arrester for Filtering Purposes.

The design of the Sly Dust arresters is based on accomplishing the following results:

It filters the dust-laden air through cloth screens.

It places extremely large cloth areas for filtering purposes in a comparatively small space in such a manner that the effectiveness of every square foot of filtering surface will not be destroyed or minimized.

It provides a large open chamber so that the velocity of the dust-laden air entering the arrester at comparatively high velocity may be reduced to a minimum so most of the dust particles will drop immediately and not overload the filter cloth which in this manner only collects the finest floating particles.

Thorough cleaning of dust-laden air so that it many be discharged into the building free of all dust, which means a saving of heat in cold weather and increased ventilation at all times.

Connection of the suction creating medium (exhaust fan) to the clean air side of the arrester. No dust whatever passes through which would have a wearing effect on the blades and housing of the fan.

Comparatively large cloth filtering surface per cubic foot of air handled.

Elimination of mechanical parts as much as possible.

Accessibility of every part of the arrester, inside and outside.

Standard construction of all parts not only to reduce the first cost of equipment but also to permit of easy assembly and quick renewal of any parts that may need replacement.

Comparatively large storage capacity for dust materials.

Convenient discharge of accumulated dust materials.

Confinement of dust for improvement of working conditions, prevention of damage to machinery and prevention of disfiguring of building inside and outside.

Easy disposal of accumulated dust.

Weather-proof construction for location of arrester against sides or on roof of buildings.

Further particulars regarding dust and dust collectors will be furnished by W. W. Sly Manufacturing Co., Cleveland, Ohio.

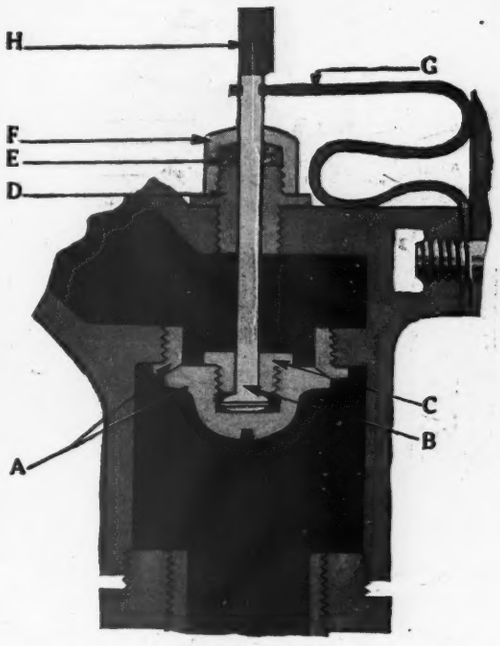
Soot Blower With an Automatic Steam Valve.

An entirely new principle has been introduced in soot blower design in the new "Valv-in-Head" soot blower now being placed on the market by the Diamond Power Specialty Co., Detroit. The valve controlling the individual unit has been incorporated as an integral part of the head. The resultant operating economies are said to be quite large. The past few years have witnessed a marked growth in appreciation of the importance of rapid and thorough mechanical removal of soot from the heating surfaces of steam generators. Coal and labor have constantly advanced in price. At the same time there have been unprecedented demands upon the boiler capacity of practically every boiler plant. The situation has called for systematic study of every factor affecting combustion. This analysis has proved the mechanical soot blower to be one of the best paying devices in the boiler room.

It has been demonstrated by dozens of tests and by practical experience in thousands of plants, according to the statements made, that mechanical soot blowers will, on the average, effect such important economies as a saving of 4 to 8% in fuel, an increase in over-all efficiency of 3 to 4%, a decrease in consumption of steam required for cleaning, and a marked saving in labor and labor turnover.

In view of these economies it is not surprising to find that a single manufacturer of mechanical soot blowers has been installing equipment for several years at the rate of 2,500,000 hp. annually. A large measure of the success of the mechanical soot blower has been due to the constant improvement in design and construction. Among the improvements of the past few years are the following: (1) The introduction of calorized metal for the protection of the blower elements from oxidation at high temperatures; (2) the adaption of nozzles of a "Venturi" section to secure the highest possible velocity of the steam jets; (3) the development of special processes for welding these nozzles in place; (4) the designing of steel bearings to support the blower elements; and (5) the introduction of the vertical-header system of piping. The successes heretofore registered have proved a spur to further efforts with the development of the new "Valv-in-Head" soot blower.

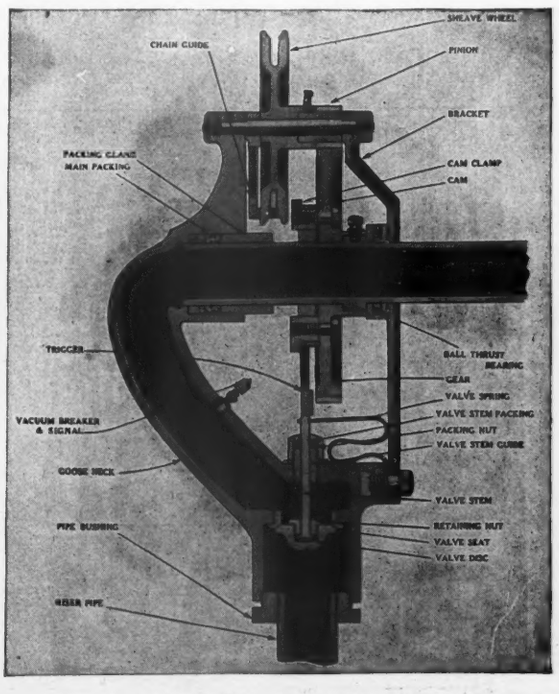
This new equipment is provided with a special "monel" valve of the poppet type placed at the base of the gooseneck. This valve takes the place of the globe valve which has heretofore been installed (at a distance of 2 to 15 ft. or more from the head) in the riser pipe leading from the main header. The special valve just referred to is located at the point marked "A" in the illustration, Fig. 1. The unit is operated in the following manner: The main control and drain valves—the only independent valves on the soot-blower line—having first been opened, and all piping drained and heated, dry steam fills the line to the entrance of the individual valve at the base of the goose-neck "A." The sheave wheel "B" is then revolved by pulling the chain. This turns a small cut pinion (not visible in the illustration). The small pinion engages the large gear "C" which is fixedly mounted on the blower element. As the gear is revolved it operates the cam "D", which causes the lever "E" to press down the valve stem "F", causing the valve to open at a predetermined point in the revolution. After the gear has been further rotated the cam "D" releases the lever "E", allowing the steam pressure to close the valve at a second predetermined point in the revolution. As steam leaves the line the spring "G" holds the valve closed.



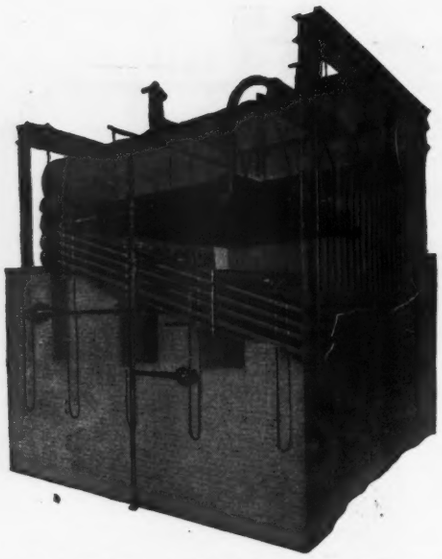
Cross-Section of Complete Head of Soot Blower.

The valve is made with "Monel" metal disc and seat, and both the stem and its retaining nut are made of nickel steel. In order to secure extra hardness which ensures durability the end of the stem is heat treated. A special feature is the provision of a guide on the seat which permits leaving the stem loose in the disc so that the valve will always seat properly. The entire construction is such that the troubles common to globe valves such as wire-drawing, leakage, etc., are almost entirely eliminated. The disc and seat are readily accessible so that they may be removed easily for regrinding or

Assembled "Valv-in-Head" Soot Blower Unit.



Cross-Section of Valve Used With New Soot Blower.



Application of "Valv-in-Head" Soot Blower to Actual Boiler Setting.

renewal should occasion require. As the tendency toward high pressure and superheat is very marked in modern power-plant design the company manufactures a special steel body "Valv-in-Head" soot blower for such boilers as require this type of equipment.

The movement of the cam is positive to provide for the complete automatic opening of the valve at each operation. The cam and the clamps which hold it in place are made of steel. The length and relative position of the cam is individually determined for each unit at the time of the installation. The valve lever, which is also made of steel, is designed with a ratio of two to one, and as the reduction of the gears is ten to one, the opening of the valve is readily accomplished. The spring is made of chrome vanadium and, as the spring is away from heat, it always keeps its tension.

Each head is provided with a vacuum breaker for the purpose of preventing the suction of furnace gases into the blower element during the periods when steam is off the unit. In the present head this vacuum breaker has been designed in the form of a small brass whistle. During the time that the soot blower is in operation the whistle sounds, furnishing both an audible and a visible signal, so that there is no opportunity for the operator to leave steam on the unit for a moment during which he is not revolving the blower without the fact becoming readily apparent to any one in the vicinity.

The advantages of the "Valv-in-Head" soot blower as compared to soot blowers of the independent valve type, include, according to the manufacturer, a saving of approximately 50% in labor, a saving of 20 to 50% or more in steam, a saving of 50 to 60% in the cost of pipe, valves and fittings, a reduction in annual charges of 25 to 50% or more, and greater cleanliness of the boiler. Other advantages, while primarily of a mechanical nature, have an important dollars and cents value. The new equipment is especially adapted to replace other blower heads, and the head is made in one size for all boilers. Steam may be intermittently discharged over two or more arcs in revolution. The arc or arcs of steam jets within the boiler invariably cover exact predetermined limits. The speed at which the blower element may be revolved is so controlled by reduction gearing as to make improper operation unlikely. Each unit is provided with a visible and audible signal to indicate when the valve is open. The revolving motion is always in the clockwise direction so that the blower element cannot work loose fom the head, either partially or entirely.

The time of opening and closing is exactly adjusted to soot blower operating conditions, being slower than the standard quick-opening valve and faster than the standard globe valve. Quick-opening valves have the disadvantage of causing a sharp thrust of the unit, due to rapid admission of the steam. With globe valves the tortuous passages cause marked reductions in effective pressure. There are also losses of time and of steam, from the slow opening and closing—losses which may seem of small amount as respects a single operation, but which become important when spread over a period of time and a number of boilers.

One of the most important results of the use of the "Valv-in-Head" blower is the practical elimination of the possibility of water entering the portion of the soot blower inside the boiler. With the "Valv-in-Head" system any condensate in the main supply line is discharged through the drain pipes before blowing begins. There is, therefore, no water below the valve which can be carried into the blower head, and the radiation area in the head itself is so small as to be negligible. Hence there is practically complete elimination of condensate from the blower element.

With the "Valv-in-Head" system, the length of time of blowing is said to be cut in half. There is no working back and forth from chain to valve, a single round trip completing the cycle of operations. This effects a saving in labor as well as in steam. One of the results achieved by this design is the positive control of the direction of the steam jets within the boiler. The jets blow only when the nozzles are directed at parts of the boiler from which deposits of soot must be removed. The steam is automatically cut off from the blower element at the precise point in the revolution of the blower element at which the jets would begin to strike the baffles or other parts which might possibly be effected by contact with the live steam. A striking advantage is that the cam may be so constructed as to permit blowing of the unit at two or more arcs in the revolution. This means that steam may be cut off when the jets approach a baffle and turned on again when the baffle is passed. With oil-fired boilers this ability to control the arc of the steam jets is a particularly valuable feature, since it makes possible the avoidance of interference with draft.

Lane Signal Accessories Co., Sayre, Pa., which was recently organized, will manufacture relays, indicators, switch boxes, lightning arresters and other accessories to an automatic system of signals.

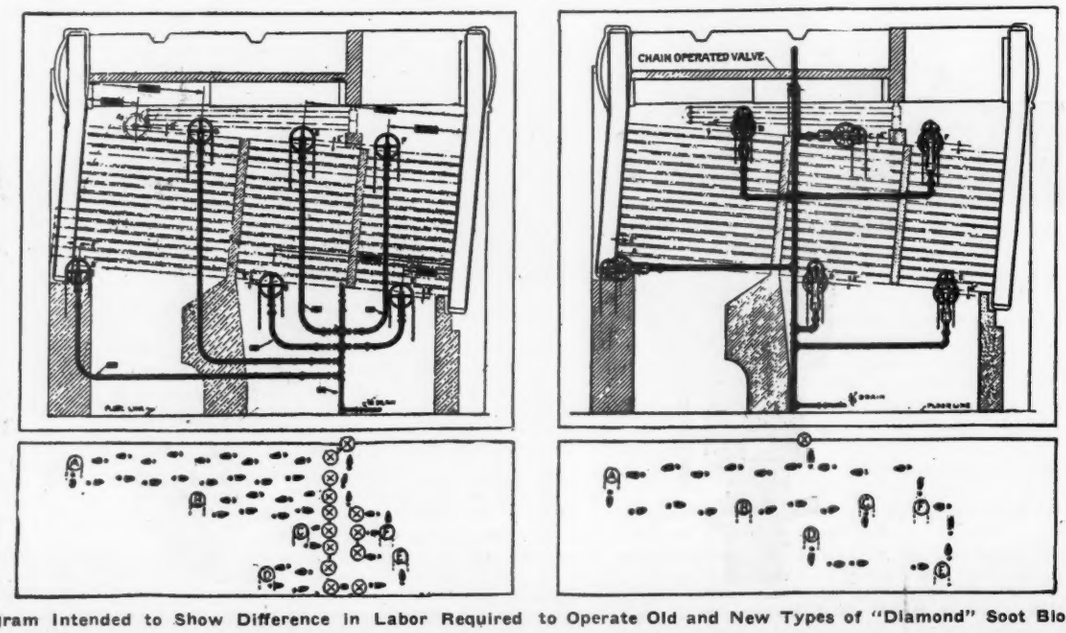


Diagram Intended to Show Difference in Labor Required to Operate Old and New Types of "Diamond" Soot Blowers.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Imperial Electrical Co., Union City, Ind., has filed notice of increase in its capital stock from $25,000 to $50,000.

General Electric Co., Lynn, Mass.,, has announced a wage reduction at its local plant, affecting about 12,000 employes.

Crocker-Wheeler Co., Ampere, N. J., manufacturer of motors, has filed plans for the erection of a 1-story extension at its plant.

Milford Storage Battery Co., Milford, Del., is planning the rebuilding of its plant, recently destroyed by fire, with loss estimated at $25,000.

Electro-Magnetic Tool Co., 2902 Carroll avenue, Chicago, has issued bulletin No. 30 descriptive of its line of portable electric drills, grinders and hammers.

Oilgear Co., Milwaukee, recently incorporated to manufacture transmission devices and specialties, has increased its capital stock from $100,000 to $300,000 preferred stock and 25,000 shares of common stock without par value.

Arctic Corp., Michigan City, Ind., which was recently organized with a capital of $200,000, will manufacture refrigerating machinery. S. W. Wilhelm, E. E. Mikesell and R. L. Henry are among those interested in the company.

Allis-Chalmers Manufacturing Co., Milwaukee, has issued bulletin No. 1106-A, entitled "Type 'E' Direct Current Motors and Generators," which is a reprint and revision of a former bulletin compiled by the company on this subject.

Wickey Battery Co., East Chicago, Ind., recently incorporated with a capital stock of $75,000, will manufacture electric batteries and machinery. The directors of the company are E. W. Wickey, W. G. Wickey, H. E. Zoeger, D. L. White and J. E. Francis.

M. H. Detrick Co., 155 East Superior street, Chicago, manufacturer of arches and steam jet ash conveyors, has announced the appointment of H. W. Thompson, 503 Mining Exchange building, Denver, Colo., as its sales representative in that territory.

Ideal Electric & Manufacturing Co., Mansfield, O., has issued a technical bulletin on "Synchronous Motors for Power and Power-Factor Correction." All technical articles, data and descriptions were written and compiled by Theodore Schou, chief engineer of the company.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., describes and illustrates in catalog 9-C the new line of electric furnaces which has recently been added to the company's products. This type of furnace includes the multiple unit designed for use with heats of 1800 to 2000 deg. F. The small "Hevi-duty" furnaces of the multiple crucible type may be operated continuously at 2000 deg. F. "Hevi-duty" industrial furnaces with applications for annealing, hardening, drawing and enameling, are described in minute detail in this publication. A discussion of the characteristics of these furnaces is also given.

Cutler-Hammer Manufacturing Co., Milwaukee, manufacturer of electric controlling devices, has announced that its Cincinnati office has been moved from the Gwynne building to the Dixie Terminal building. A. H. Maujer, formerly of the sales engineering force of the Pittsburgh office, is now in charge of the Cincinnati office.

Pawling & Harnischfeger Co., Milwaukee, is distributing Bulletin 6X, describing and illustrating the latest addition to its excavating machinery—the P. & H. Excavator—Crane No 206. This is a full revolving, all-corduroy portable crane and excavator, constructed of unusually good material. There are a multitude of uses for the machine made possible by seven distinct attachments.

S. R. Fralick & Co., 15 South Clinton street, Chicago, manufacturers of the "Kwikon" line of wiring devices and conduit fittings, have announced the appointment of the following sales agents to represent them in the territories indicated: Watts & Barry, Inc., 50 Church street, New York City, for the Metropolitan district; P. L. Hoadley, 609 Seaboard building, Seattle, for the north Pacific coast territory, and J. J. Schaller, 257 Spring street, Los Angeles, southern Pacific coast territory.

Conveyors Corporation of America, formerly the American Steam Conveyor Corporation, Chicago, announces that the Power Equipment Co., 131 State street, Boston, has been appointed as New England representative for the sale of its American Trolley Carrier, monorail equipment for handling coal, ashes, sand, gravel and other loose bulky materials. Colwell & McMullin, 79 Milk street, Boston, are the New England representatives for its American Steam Ash Conveyor.

Bigelow Co., New Haven Conn., has issued a 48-page booklet dealing with horizontal return tubular boilers from the viewpoint of the user. According to the text the essentials of a quality boiler is that it develops the maximum amount of horsepower per ton of coal consumed and at the lowest cost of maintenance. This statement is followed by an enumeration of the factors which govern such performance. A lengthly discussion is given next which takes up the various steps of manufacturing and includes operation of a flange press, machining, rolling, cutting tube holes, etc. This section is illustrated. Several reproductions of the different types of boilers follow. Statistical tables have been included in the contents as follows. Horse-power rating of horizontal return tubular boilers with measurements for setting and data for horizontal return tubular boilers with overhanging fronts, flush fronts, and for structural works; standard boiler tubes; saturated steam pressure table; weight of black or galvanized standard pipe; decimals of an inch and foot for each 1/64 in., Kent's table on sizes of chimneys for steam boilers; and flue areas required, rating according to boiler horsepower. Blue prints are provided of boilers of various diameters and the number of tubes in each, and cross-sectional areas of the same types.

Thoner & Martens, 463 Commercial street, Boston, electricians and machinists, have issued a loose-leaf catalog illustrating and describing their line of disconnecting switches, heavy-duty switches and "T & M" switch locks. It is stated that the high-tension indoor disconnecting switches listed in the bulletin can be supplied in any desired size up to capacities of 3000 amperes at a voltage rating of 15,000 volts, and that the heavy-duty low-tension switches are furnished in capacities of 20,000 amperes at 250 volts d-c.

Morse Chain Co., Ithaca, N. Y., is making preparations for its exhibit at the Seventh National Exposition of Chemical Industries to be held at the Eighth Coast Artillery Armory, New York City, during the week of Sept. 12. The exhibit will include a large Morse rocker joint silent chain drive with the washers of the chain removed from one side and a revolving shutter ingeniously arranged so that the rocking action of the joint can be followed as the chain goes on and off the sprockets. It is stated that the drive is capable of transmitting 100 hp. and withstanding an occasional overload of 100%. This chain is a 2-in. pitch, 5 ins. wide and is provided with internal guiding links which run in corresponding grooves in the sprockets. The drive is mounted on a heavy framework and is driven by a small motor connected up through a small Morse chain drive. There will also be other small drives, as used for connecting individual motors to machines instead of for replacing gear drives and belt drives. There will also be exhibited a number of samples of different size chains, showing the Morse rocker joint. These will range from ⅜-in. pitch to 3-in. pitch and in several widths, illustrating the chain as used for horsepower ranging from 0.5 to 5000 hp. There will also be a number of photographs of actual installations. These will show the advantages to be derived from using silent chain drives. There will also be exhibited data as to results. F. G. Anderson, New York manager of sales, will be in charge and representatives of the sales department and others will be in attendance.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

F. L. BAER, since 1919 contract sales manager of the Automatic Electric Co., Chicago, has been appointed assistant chief engineer.

R. M. CRITCHFIELD, formerly assistant chief engineer of the Dyneto Electric Corp., Syracuse, N. Y., is now associated with the Remy Electric Co., Anderson, Ind.

GORDON W. FALLIS, formerly electrician with the Puget Sound Power & Light Co., Dieringer, Wash., is now with the Lighting Department of the city of Seattle.

H. H. BRADLEY has left the Schenectady, N. Y., office of the International General Electric Co. to become special representative of the company in San Juan, P. R.

H. E. MURPHY, district manager of the St. Louis Brass Manufacturing Co. at Chicago, has accepted an appointment as representative of the Natioanl Council of Lighting Fixture Manufacturers to collaborate with the Board of Fire Underwriters.

ARTHUR W. THOMPSON, of Pittsburgh, president of the Philadelphia Co. and affiliated corporations, was recently honored with the degree of Doctor of Laws which was conferred upon him by St. John's College, Annapolis, Md., and the University of Pittsburgh in recognition of his untiring efforts during the war and in civic development.

BRIG. GEN. GEORGE H. HARRIES, vice-president of H. M. Byllesby & Co., Chicago, who acted as chief of the allied commission in charge of prisoners of war in Germany after the armistice, has been decorated with the Order of Leopold by the Belgian ambassador, Baron deCartier, in recognition of his services in behalf of the Belgian prisoners. The ceremony took place recently at the Belgian embassy in Washington, D. C., in the presence of officers of the Belgian and American armies.

ELMER THEMES, an employe of the Public Service Co. of Northern Illinois, 72 West Adams street, Chicago, for many years, has been placed on the service annuity list. Mr. Themes' state of health compelled him to retire from active work as power supervisor more than a year ago, and he has since lived in California. He entered the employ of the Economy Light & Power Co. in Joliet, Ill., in 1889, and when that concern was merged with the Public Service Co. of Northern Illinois he came into the service of the latter.

E. W. MARTIN, who has been connected with the Westinghouse Electric & Manufacturing Co. for 11 yrs., has left the company for a vacation which he will spend in travel and the study of engineering and business conditions, as well as in pleasure. After his vacation it is probable that he will again devote his time to either engineering or sales electrical work. Mr. Martin was at one time connected with the Benham Engineering Co. as consulting electrical engineer. During his affiliation with this firm he laid out and installed the municipal water and lighting plant for the city of Wellington, Kan. This was an undertaking requiring a year and costing approximately $500,000. He is a graduate of the University of Illinois, class of 1910. After his graduation he went with the Westinghouse Electric & Manufacturing Co. as a 2-yr. apprentice. He finished and graduated from his apprenticeship course in 18 mo. While still

E. W. Martin.

on the course he was sent to Charleston, W. Va., as a power plant tester in the Kanawha and New River coal mines, and after working in this position for the Virginian Power Co. a few months he became engineer in charge of the mine tests and later was sent out to close power contracts in the mines for the power company. Within a year sufficient load had been obtained so that the steam plant at Cabin Creek Junction was built. He was one of the pioneers in this development and proved that power contracts could be had if a plant was in operation. From Charleston, Mr. Martin and the crew went to Birmingham, Ala., and worked along similar lines for the Alabama Power Co. in loading the plant at Lock No. 12. The data from tests and the motor application data were used in the publication of a handbook which was distributed to power solicitors. After completing his part of the work in Alabama, Mr. Martin went into consulting and construction work in Kansas, as stated. From there he went into sales engineering work for his old company and has been so employed up to his leaving. As a sales engineer he secured the largest arc welding equipment job up to that time, as well as securing several contracts around $100,000 in electrical equipment.

R. J. ANDRUS has resigned from the Central Power Co., Grand Island, Neb., to become connected with the Middle West Utilities Co., Chicago.

DR. IRVING LANGMUIR, assistant director of the Research Laboratory of the General Electric Co., Schenectady, N. Y., sailed for Europe Aug. 13 to attend the annual meeting of the British Association for the Advancement of Science to be held in Edinburgh, Scotland, Sept. 7 to 14. He will also attend a meeting of the Faraday Society in London Sept. 28 and will be awarded the honorary degree of Doctor of Laws by the University of Edinburgh Sept. 13. Dr. Langmuir will open the discussion on "Molecular Structure" at the British Association meeting. He will read a paper before the Faraday Society on "Chemical Reactions on Surfaces," and open the discussion on that subject. During his stay he will visit a number of European countries on business. He is expected to be absent from the United States between 2 and 3 mo.

OBITUARY.

FRANK E. WOODWARD, president of the heating and ventilating engineering firm of Frank E. Woodward & Co., 19 Friend street, Boston, died Aug. 5 from the effects of an accident with which he met the previous week. He was 68 yrs. of age.

GEORGE W. THOMAS, president of The R. Thomas & Sons Co., East Liverpool, O., pioneers in the manufacture of electric porcelain in Ohio, died Aug. 7, following an illness extending over a period of 10 mo. He was born in East Liverpool, April 20, 1852, a son of Richard and Esther Thomas. As a boy he learned the door knob manufacturing business, and in 1869 he became associated with his father in the manufacture of door knobs at Beaver Falls, Pa. In 1873 the elder Thomas disposed of his interest in the Beaver Falls factory and returned to East Liverpool, where, with his son, George W. Thomas, he organized The R. Thomas & Son firm, which engaged in the same line of business in a 1-kiln plant in Baum street. In later years the firm name was changed to The R. Thomas & Sons Co. Under the management of the father and son, the firm prospered. Additions were erected to the factory and the capacity increased from time to time until now the company has a 12-kiln plant in East Liverpool and a 10-kiln factory in Lisbon, O. The latter plant was originally erected for the manufacture of tableware, but in 1895 it was made a branch of the East Liverpool factory and was devoted exclusively to the electric porcelain business. Mr. Thomas was a director of the Potters' National Bank from its organization and was also a director of the Ohio Silica Co., of East Liverpool, and the National Silica Co., of Oregon, Ill. He is survived by two daughters, two sons, three brothers and three sisters.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Concord, N. H.—Considerable electrical machinery and equipment will be installed in the local locomotive shops and engine house to be erected by the Boston & Maine Railroad Co., North Station, Boston, estimated to cost $200,000. The contract for the buildings has been awarded to the H. Wales Lines Co., Meridan, Conn.

Cambridge, Mass.—The Cambridge Gas Light Co., Third street, has filed plans for extensions and improvements at its power house to cost about $60,000, including equipment.

Charleston, Mass.—The Charleston Gas & Electric Co. is planning the rebuilding of its coaling tower at Arlington avenue and Hamblen street, recently damaged by fire with loss of about $15,000.

Everett, Mass.—The Malden Electric Co. has filed plans for the construction of a substation at Oakland avenue and Broadway to cost about $65,000.

Worcester, Mass. — Considerable electrical equipment will be installed in the automobile manufacturing plant on Millbrook street, to be constructed by the R. H. Long Co., with cost estimated to be $200,000. A 1-story power house, estimated to cost $22,000, will be erected. Plans have been completed.

Hartford, Conn.—The Departments of City Health and Charity have awarded a contract to G. Cudemo, 327 Trumbull street, for the erection of a power house and mechanical laundry plant on Holcomb street, to cost $80,000.

Middletown, Conn.—Electric equipment will be installed in the 1-story mechanical laundry plant, 40 by 100 ft., to be erected by the Forest City Laundry, 56 Hamlin street. Plans for the building have been filed.

New Haven, Conn.—The United Illuminating Co. has awarded a contract to the Standard Construction Co., Plymouth building, for the erection of a building at its power house, 60 by 64 ft.

Beacon, N. Y.—The Southern Dutchess Gas & Electric Co., 89 Main street, has made application to the Public Service Commission for permission to build an addition to its electric power plant at East Fishkill.

Brooklyn, N. Y.—A new 2-story power house, 52 by 68 ft., will be built by the Artistic Dyeing Co., 100 Jewel street, at Meserole avenue and Moultrie street, estimated to cost $18,000. Plans have been completed.

College Point, L. I., N. Y.—Considerable electrical equipment will be installed in the local plant at Fifth avenue and Eighteenth street, to be erected by the I. B. Kleinert Rubber Co., 725 Broadway, New York. It will be 4-story and basement, estimated to cost $150,000.

Corinth, N. Y.—The Corinth Electric Light & Power Co. has made application to the Public Service Commission to construct an addition to its local electric power plant.

Fillmore, N. Y.—The Fillmore Electric Co., Inc., is perfecting plans for the construction of a transmission line from Belvidere to Friendship, with distributing system at the latter point for light and power service. Application for permission has been made to the Public Service Commission.

Long Island City, N. Y.—The New York & Queens Electric Light & Power Co. is taking bids for the erection of its proposed building on Amity street, Flushing, L. I., to cost $200,000.

New York, N. Y.—The General Illuminating Co. has filed notice of increase in capital from $10,000 to $25,000.

Ossining, N. Y.—The Superintendent of State Prisons, C. F. Rattigan, Capitol building, Albany, N. Y., has taken bids for the erection of an addition to the power house, Sing Sing Prison, Ossining.

Poughkeepsie, N. Y.—The Central Hudson Gas & Electric Co., 50 Market street, has petitioned for authority to construct an extension to the electric plant in the town of East Fishkill, Dutchess county, New York.

St. Lawrence, N. Y.—The Milling & Lighting Co., Brasher Falls, has made application to the Public Service Commission for permission to build an addition to its local plant. A franchise for the work has been granted by the local Common Council.

Dover, N. J.—The New Jersey Power & Light Co. has made application to the Board of Public Utility Commissioners for permission to acquire the Lambertville Public Service Co., the Flemington Light & Power Co. and the Newton Gas & Electric Co., operating at Lambertville, Flemington and Newton, respectively. It is proposed to merge the systems with the lines of the purchasing company, with unit organization operation.

Glassboro, N. J.—The Borough Council has entered into a contract with the Electric Co. of New Jersey for the installation of a street lighting system on the principal thoroughfares, with service charge at the rate of $25 per lamp per year. The gas street lighting system, heretofore furnished by the New Jersey Gas Co., will be abandoned, and the equipment removed.

Lake Denmark, N. J.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning extensions and improvements in the local electric power plant of the Government.

Trenton, N. J.—The City Commission will install new street lamps on South Montgomery street, with underground conduit system to be laid by the Public Service Electric Co., which will furnish service. Commissioner Page is in charge.

New Castle, Del.—The Water and Light Commission is planning extensions and improvements in the local street lighting system. Service is being furnished by the Wilmington & Philadelphia Traction Co., Philadelphia, Pa., which will handle features of the installation. T. J. Heisel is superintendent.

New Castle, Del.—The local fire department is considering the installation of an electrically operated fire-alarm system. A committee, headed by John P. Leonard and James V. Campbell, has been appointed to arrange details and secure estimates of cost.

Allentown, Pa.—The City Council has approved plans for an extension of the street lighting system on Hamilton street, from Penn to Second street, and on South Seventh street, from Hamilton to Walnut street.

Harrisburg, Pa.—Considerable electrical and mechanical equipment will be installed in the addition to be constructed to the municipal filtration plant at Island Park, by the City Council, estimated to cost $800,000.

Philadelphia, Pa.—The James Doak, Jr., Co., 2185 East Norris street, has filed plans for the erection of a 1-story power house at its worsted yarn manufacturing plant.

Philadelphia, Pa.—The Philadelphia Electric Co. has filed plans for the erection of a 1-story building at Schuylkill avenue and Bainbridge street, to be used for general operating service.

Pittsburgh, Pa.—The Sargent Electric Co., Inc., has been awarded a contract for the installation of a new A-C transmission system in the Mayview district of the city, to include overhead and underground lines, ornamental lighting standards and other work.

Pittsburgh, Pa.—Electrical and mechanical equipment, refrigerating apparatus, etc., will be installed in the provision storage warehouse to be erected by Kingan & Co., Indianapolis, at 1119-21 Penn avenue, estimated to cost $150,000. Sidney F. Heckert, Pittsburgh, is architect.

Pottsville, Pa.—A number of electric power companies have been incorporated in this section, each with a nominal capital of $5000, to operate local systems. The different companies are the Laceyville Borough, Wyoming, Mehoopany township, Meshoppen township, Forkston township, Wyalusing Borough, Windham township, Wyalusing township, Wilmont township, Washington township, Terry township and Meshoppen Borough Electrical companies. Charles W. Riggs, Pottsville, is treasurer.

Reading, Pa.—The Philadelphia & Reading Coal & Iron Co. is planning

extensions in its high-tension electric transmission system in the vicinity of Shenandoah, Pa.

Scranton, Pa. — The Delaware, Lackawanna & Western Railroad Co., Coal Mining Department, has awarded a contract to L. T. Stipp, Union National Bank building, for the erection of an electric substation at its Bellevue Colliery, estimated to cost $25,000.

Baltimore, Md.—Considerable electrical equipment will be installed in the plant to be erected by the Cooknut Corp., Lexington and Paca streets, for the manufacture of lard substitutes, in the Canton section, estimated to cost $125,000.

Baltimore, Md.—Electrical and mechanical equipment will be installed in the garbage disposal plant to be constructed at Bodkin Point by the Sanitary Reduction Co., 3 East Lexington street, estimated to cost $50,000.

Baltimore, Md.—The Electrical Department of the city, in co-operation with the Board of Fire Underwriters, has arranged a committee for improving electrical installations with respect to wiring and other work. New rules will be drafted for different types of installations.

Port Deposit, Md.—The Northern Maryland Electric Co. has taken over the Port Deposit Electric Co., and will operate the system as a part of its general distributing lines.

Washington, D. C.—The Department of the Interior is arranging for the installation of new stokers at the central power plant of the Freedmen's Hospital. Bids have been asked. F. M. Goodwin is assistant secretary.

Danville, Va.—The Chesapeake & Potomac Telephone Co., G. H. Warren, division manager, 5 Light street, Baltimore, has authorized the expenditure of $7260 to install a telephone cable extension from Danville to Schoolfield. The work includes the erecting of 31 poles, stringing 6900 ft. of aerial cable, etc.

Waynesboro, Va.—The South River Mutual Telephone Corp. has been incorporated with R. G. Vance as president, and J. J. Harner, vice-president. The company will install a mutual telephone system with common battery and underground cable system.

Yorktown, Va.—The Bureau of Yards and Docks, Navy Department, has completed plans for the erection of a power house at the local works of the Government.

Bluefield, W. Va.—The Clinchfield Coal Co. is planning the installation of electrical and other equipment at its local properties.

Brocius, W. Va.—Considerable electrical and mechanical equipment will be installed in the plant to be constructed in this section by the Hancock Steel Co., Martinsburg, W. Va., estimated to cost $3,000,000. Ernest McGeorge, 1900 Euclid avenue, Cleveland, Ohio, is engineer.

Glen White, W. Va.—The E. E. White Coal Co. is planning extensions in the power house at its property, the installation to include boilers, stokers and other equipment. E. E. White is president and general manager.

Hickory, N. C.—The Hickory Power Co. has been incorporated with a capital of $200,000 to equip and operate an electric light and power plant. The incorporators are B. M. Spratt, L. F. Abernathy and J. A. Moratz.

Apalachicola, Fla.—The Apalachicola Land & Development Co. is planning the installation of an electric power plant at its local properties. J. J. Abbott is secretary and manager.

DeLand, Fla.—The DeLand Electric Light, Power & Ice Co. will install new equipment at its local power house.

NORTH CENTRAL STATES.

Ashtabula, O.—The City Council has taken bids for the construction of certain portions of its proposed municipal electric generating plant, to be 80 by 80 ft., and estimated to cost $100,000. Stone & Webster, 147 Milk street, Boston, Mass., are engineers.

Cincinnati, O.—The Cincinnati Gas & Electric Co. has arranged a note issue to total $6,000,000, the proceeds to be used, in part, for the construction of substations, transmission and distributing lines, and other expansion. Charles D. Jones is president.

Cleveland, O.—The Cleveland Electric Illuminating Co. has arranged for a bond issue of $5,000,000, the proceeds to be used for extensions, improvements, general operations, etc.

Alma, Mich.—The City Commission has voted to extend the boulevard lighting system from Gratiot avenue to the Race bridge on East Superior street. Continuation of the boulevard system north on State street is being agitated.

Ravena, Mich.—Holland, Akerman & Holland, 106 East Liberty street, Ann Arbor, Mich., are preparing plans for an $85,000 hydroelectric plant to be erected by the Ravena Conklin Electric Light & Power Co. T. Rogers is interested.

Carlisle, Ind.—The Knox & Sullivan County Light & Power Co. has been incorporated with a capital of $75,000 to operate a local light and power system. Murray Owen, J. D. Roswell and N. S. McGillivray head the company.

Indianapolis, Ind.—The Board of County Commissioners will make improvements and extensions in its power house at the County Jail.

Peru, Ind.—The Board of Education will make extensions and improvements in the power house at the high school to cost about $80,000. Ammerman & McCall, Occidental building, Indianapolis, are engineers.

Chicago, Ill.—Architect L. C. Holmboe, 3426 East 89th street, is preparing plans for a $350,000 3-story electric power plant to be erected by the Illinois Steel Co. of South Chicago.

Hillsboro, Ill.—The Bond County Telephone & Telegraph Co. will start the construction of a line from Greenville to Ayers about Sept. 1.

St. Paul, Minn.—The City of St. Paul has applied to the Federal Power Commission for a preliminary permit to develop power at the U. S. Government dam, in the Mississippi river, to be used for public uitlity purposes.

Ft. Madison, Ia.—A survey is being made of Fort Madison for the installation of a modern lighting system. Mr. Duncan, head of the Duncan & Schell Furniture Co., is interested.

Griswold, Ia.—An election will be held this month to vote on the question of issuing $50,000 light and power bonds. Address town clerk.

St. Louis, Mo.—The Excelsior Laundry Co. has awarded a contract to the Furin Colnon Construction Co., St. Louis, for the erection of a mechanical laundry plant and power house at Texas and Victor streets, estimated to cost $200,000, with equipment.

Dexter, Kans.—An election was held Aug. 12 to vote on the question of issuing bonds to build an electric power line to Winfield. Address W. R. Coffee, mayor.

Haddam, Kan.—Engineer W. B. Rollins, 209 Railway Exchange building, Kansas City, Mo., is preparing plans for a $22,000 transmission line and distribution system. Address E. L. Bowman, city clerk.

Lawrence, Kan.—The Board of Directors of the State College has broken ground for the erection of the proposed power plant at the institution, estimated to cost $100,000. It will be 2-story, 76 by 118 ft.

Beatrice, Neb.—An election will be held in September to decide the question of granting a 25-yr. franchise to the Gage County Gas & Electric Co. The City Commissioners may call an election to vote on issuing municipal light bonds. W. H. Anderson, city electrician, has been instructed to prepare an estimate of the expense of installing a plant in the city sufficient to care for the needs of users of electric energy.

Pawnee City, Neb.—The Merkle Machinery Co., Kansas City, Mo., has been awarded a contract for building an electric light and power plant at an estimated cost of $67,000. Address the mayor.

Bruce, S. D.—Bonds to the amount of $12,000 have been voted for the purpose of connecting Bruce with a high-tension electric power line. As soon as the bonds are sold the city officials will enter into a contract with either the power plant of Brookings or the Dakota Light & Power Co., of Flandreau, to furnish a 24-hr. electric service.

Dunn Center, N. D.—The elevator and lighting plant burned recently at an estimated loss of $30,000. The Equity Elevator Co. is the owner.

SOUTH CENTRAL STATES.

Brooksville, Ky.—The Kentucky Power Co. has been chartered under state laws to operate a local light and power system. S. B. Barrett and A. B. Waters, Cincinnati, head the company.

Louisville, Ky.—Considerable electrical equipment will be installed in the 3-story addition to be erected at the plant of the Henry Vogt Machine Co., West Ormsby avenue, manufacturer of ice and refrigerating machinery, estimated to cost $60,000.

Calhoun City, Miss.—The City Council has completed plans for the construction of a municipal electric power plant, and will commence construction at an early date. Tilden Pryor is city clerk.

Starkville, Miss.—The Board of Directors of the Mississippi Agricultural College, has awarded a contract

to Estes, Williams & Ragsdale, Memphis, Tenn., for the construction of a 1 and 2-story power plant at the institution, about 40 by 130 feet.

Cedar Grove, La.—The Shreveport Home Telephone Co., Shreveport, La., has been granted a franchise for the installation of a local system. It is estimated to cost $25,000.

Judsonia, Ark.—The Arkansas Hydroelectric Co., Boyle building, Little Rock, Ark., will commence the immediate construction of its proposed hydroelectric power plant on the Red river. Contract for certain features of the work has been awarded to J. Livingston & Co., Grand Central Terminal, New York. The project will include a gravity type dam, with generating station of 22,000 hp. initial capacity, and transmission lines totaling close to 90 mi. It is proposed to furnish service at Judsonio, Searcy, Kensett, Augusta and neighboring sections. J. E. Sirrine, Greenville, S. C., is consulting engineer for the project. E. T. Stanfield is vice-president and general manager of the Arkansas company.

Little Rock, Ark.—The Arkansas Light & Power Co. has filed notice of increase in capital from $4,750,000 to $5,750,000.

Claremore, Okla.—The Common Council is considering plans for the installation of an electric lighting system. J. M. Davis, mayor, is in charge.

Pawhuska, Okla.—The Board of City Commissioners has plans under way for enlargements in the municipal electric power plant. New equipment will be installed for increased capacity.

Moulton, Tex.—F. T. Fehrenkamp and E. Boehm are promoting the organization of an electric light plant and an ice factory. Approximately $30,000 worth of stock has been subscribed and erection is assured.

New Braunfels, Tex.—The Planters & Merchants Mill Co., now being organized to construct and operate a local textile mill, has secured water rights on the Guadalupe river and plans the erection of a hydroelectric generating plant for power and light service at the mill. S. M. Ransopher, director of industrial education at the University of Texas, Austin, heads the new company.

WESTERN STATES.

Farmington, N. M.—The plant of the Farmington Electric Light & Power Co. burned recently.

Boise City, Ida.—S. K. Atkinson, assistant city engineer, on behalf of Boise City, filed an application for a permit to construct Bull Trout lake reservoir for power purposes. The proposed reservoir, to be constructed of earth, steel and concrete at an estimated cost of $25,000, will have a storage capacity of 25,000 acre ft.

Talache, Ida. — The Armstead Miners Co. propose to construct a power line from Standpoint to the holdings of the company, the power to be furnished by the Mountain States Telephone Co., of Standpoint, in order to operate a 150-ton concentrating plant at the company's mines.

Phoenix, Ariz.—James B. Girand, Gooding building, has applied to the Federal Power Commission for a preliminary permit to construct a dam and power house in the Colorado river at the mouth of Andrus canyon, in Mohave and Coconino counties, to develop about 130,000 hp. to be used for public utility purposes.

Phoenix, Ariz.—James B. Girand, Gooding building, has applied to the Federal Power Commission for a preliminary permit to construct a dam and power house in the Colorado river, just above Pierce's Ferry, in Mohave county, to develop about 130,000 hp. to be used for public utility purposes.

Tacoma, Wash.—Ordinances providing for the installation of ornamental street lamps on the downtown cross streets and for paving McKinley avenue, Wright avenue to South 40th street, and South 34th street, McKinley to Pacific avenue, were passed by the City Council and bids will soon be asked. An ordinance to authorize the installation of ornamental lamps in the McKinley park district was introduced; also one to authorize the repair of the light department substation at a cost of $3000.

Oroville, Cal.—The Hutchinson Lumber Co. will commence construction Sept. 1 on a sawmill, planing mill and box factory. The company will install electric logging machinery. O. C. Griffith is manager.

Sacramento, Cal.—The Excelsior Water & Mining Co., 920 Forum building, has applied to the Federal Power Commission for a preliminary permit for a project covering a comprehensive development of the water power in the middle and south forks of the Yuba river and in Deer Creek. The projects contemplate the construction of three reservoirs, 7 mi. of tunnel, 45 mi. of conduit, and six power houses. It is stated that 115,000 hp. will be developed, and the stored water from the lower reservoir will be used for irrigation. The proposed use is for public utility purposes.

San Francisco, Cal.—The Mt. Shasta Power Corp. has applied to the Federal Power Commission for a preliminary permit for two projects, known as Developments Nos. 3 and 4, each consisting of a dam, tunnel, and power house, located on Pit river, in Shasta county, California, to be used for public utility purposes.

San Joaquin, Cal.—A permit authorizing the San Joaquin Light & Power Corp. to increase the power of the plant almost threefold was granted recently when it appropriated 550 cu. ft. of water per sec. from the Kern river.

INCORPORATIONS.

Bridgeport, Conn.—Bridgeport Electric Supply Co. Captial, $25,000. To manufacture and deal in electrical supplies. Incorporators: A. I. Lapides, I. L. Segar, and A. W. Harris, 123 Derby avenue, New Haven.

Barnstable, Mass.—Cape Battery Co. Capital, $10,000. To manufacture and deal in electrical specialties. Incorporators: Roy F. Gammon, William S. Boice, and Raymond L. Rich.

Brooklyn, N. Y.—McFarland-Clum Corp. Capital, $75,000. To manufacture electrical devices for automotive service. Incorporators: G. T. McFarland, R. V. Clum, and J. G. Snyder, 256 Broadway, New York.

New York, N. Y.—Electric Thermo Co. Capital, $100,000. To manufacture electrical washing machinery. Incorporators: W. L. Strauss, C. C. Trautmann and C. A. Oberwager, 233 Broadway.

New York, N. Y.—G. E. Fixture Co. Capital, $25,000. To manufacture electrical fixtures. Incorporators: H. Firman, J. N. Chamkin and H. Solomon, 332 Broadway.

Jersey City, N. J.—Blek Electric Co., 249 Washington street, has filed notice of organization to manufacture electrical products. Joseph A. L. Blek heads the company.

Newark, N. J.—Donovan & Erbach Co. Capital, $125,000. To operate as electrical engineers. Incorporators: Andrew D. Donovan, J. E. Helm, and James C. Erbach, 68 Chelsea avenue.

Wilmington, Del.—Hickey Fire & Burglar Wire Co. Capital, $250,000. To manufacture wire and other electrical products. Local incorporators: T. L. Croteau, M. A. Bruce, and C. H. Maxwell.

Danvers, Mass. — Solar Electric Lamp Co. Capital, $50,000. To manufacture electric lamps. Oscar R. Bodwell is president and Peter N. Wettlaufer treasurer.

Wilmington, Del.—Vitalis Products, Inc. Capital, $13,000,000. To manufacture electric storage batteries and kindred equipment. Local incorporators: M. A. Bruce, T. L. Croteau and C. H. Maxwell.

Jersey City, N. J.—New Jersey Storage Battery Manufacturing Co. Capital, 500 shares of stock, no par value. To manufacture electric storage batteries and kindred equipment. Incorporators: Daniel E. Lenthe, M. A. and Andrew J. Weger, 26 Tyson place.

FOREIGN TRADE.

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Goods (35,286)—A mercantile company in India desires to secure the representation of manufacturers for the sale of electrical goods. References.

Electrical Equipment (35,282)—A mining company in Chile desire to secure catalogs illustrating all manner of mining machinery, oil engines, pumps, rolling stock for railways and mines, locomotives, electrical machinery and appliances, tools, lubricating oils, packings, wire ropes, steels and irons, and explosives for furnishing a railway, fleets of steamers, tugs and launches, workshops and foundries, power stations, farms, coal fields, etc. Quotations should be given c.i.f. port in Chile. References.

Electrical Apparatus (35,284)—A technical commission in Portugal desires to be placed in communication with firms in the United States engaged in undertakings such as electrification of railways and transmission of electric power; and to secure literature and catalogs from manufacturers of material and accessories pertaining thereto.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Offering of Middle West Utilities Co. Gold Notes.

Halsey, Stuart & Co. and A. B. Leach & Co., Chicago, are offering an issue of $1,500,000 Middle West Utilities Co., 20-yr. 8% secured gold notes, series "C," at a price of 95.25 and interest, yielding 8.5%. The Middle West Utilities Co. through its subsidiary companies operates in Illinois, Indiana, Kentucky, Maine, Michigan, Missouri, Nebraska, New Hampshire, New York, Oklahoma, Tennessee, Texas, Vermont, Virginia and Wisconsin. The company's subsidiaries serve 507 communities, having a combined estimated population of 1,339,500, and 73% of the company's utility earnings are from the electric light and power industry.

The earnings of the Middle West Utilities Co., as officially reported, for the 12 mo. ended June 30, 1921, show a net balance of $2,642,934.71 available for the annual interest of $1,098,050 on $6,475,000 8% secured gold notes, series "A," "B" and "C," $9,367,500 ten-year 6% collateral gold bonds and $300,000 three-year 6% gold notes. Subsidiaries of the company have been granted rate increases aggregating to date over $4,676,673 per annum.

Stock Issue of Niagara Falls Power Co. Planned.

The Niagara Falls Power Co. has arranged for a preferred stock issue, the proceeds to be used in connection with the construction of the hydroelectric generating plant of the company, work on which has been commenced. The securities will be disposed of in small denominations to employes of the company and local citizens. Paul A. Schoellkopf is president.

Idaho Power Co.

	1921.	1920.
June gross	$ 208,044	$ 226,850
Net after taxes	108,814	137,358
Total income	127,001	144,228
Surplus after charges	69,858	104,021
12 mo. gross	2,320,679	2,040,073
Net after taxes	1,153,893	1,037,910
Total income	1,326,823	1,111,736
Surplus after charges	695,274	641,708
Balance after preferred dividends	607,066	569,073

United Gas & Electric Co. and Subsidiaries.

	1921.	1920.
June gross	$ 962,670	$ 892,637
Net after taxes	324,911	251,628
Total income	349,503	287,073
Surplus after charges	132,006	91,443
12 mo. gross	12,493,207	11,225,742
Net after taxes	3,748,408	3,788,510
Total income	4,021,145	4,048,863
Surplus after charges	1,418,876	1,626,223

Montana Power Co. and Subsidiaries.

Earnings for the 3 mo. ended June 30, 1921, and comparison with same period of 1920:

	1921.	1920.
June gross	$1,323,000	$2,003,722
Net after taxes	683,606	1,340,506
Surplus after interest charges	246,148	902,119
6 mo. gross	3,053,691	4,073,745
Net after taxes	1,759,226	2,753,657
Surplus after interest charges	883,624	1,879,342

United Light & Railways Co.

For 12 mo. ended June 30:

	1921.	1920.
Gross earnings	$12,053,371	$10,995,207
Operating expenses	8,768,333	7,868,652
Net earnings	3,285,037	3,126,554
Balance available for dividends	1,410,580	1,302,599
Surplus for depreciation and common dividends	787,865	699,350

Standard Gas & Electric Co. Subsidiaries.

The combined earnings of the Standard Gas & Electric Co.'s public utility subsidiaries for the 12 mo. ended June 30, 1921, compare with the earnings of the corresponding previous year as follows:

12 mo. ended June 30	1921.	1920.
Gross revenue	$34,518,663	$29,478,902
Gross earnings*	32,999,696	28,107,675
Net earnings	11,641,806	10,858,479

*Does not include revenue collected for other producing companies.

Southern California Edison Co.

Month of June—	1921.	1920.
Gross earnings	$ 1,375,812.22	$ 1,314,259.48
Expenses and taxes	527,545.81	593,698.24
Net earnings	848,266.41	720,561.24
Fixed charges	345,635.60	258,482.59
Balance	502,630.81	462,078.65
12 Mo. ending June 30, 1921—		
Gross earnings	$16,209,088.46	$11,790,454.55
Expenses and taxes	6,791,248.20	5,314,168.02
Net earnings	9,417,840.26	6,476,286.53
Fixed charges	3,431,256.95	3,040,846.42
Balance	5,986,583.31	3,435,440.11

Fort Smith Light & Traction Co.

12 mo. ended June 30	1921	1920.
Gross earnings	$1,070,271	$974,645
Net earnings	302,234	290,288

Mobile Electric Co.

12 mo. ended June 30	1921	1920.
Gross earnings	$737,474	$758,305
Net earnings	232,868	204,671

Mountain States Power Co.

12 mo. ended June 30	1921	1920.
Gross earnings	$961,459	$864,321
Net earnings	286,517	283,739

San Diego Consolidated Gas & Electric Co.

12 mo. ended June 30	1921.	1920.
Gross earnings	$3,310,850	$2,394,446
Net earnings	951,361	859,702

Manila Electric Railroad & Lighting Corp.

	1920.	1919.
June gross	$ 310,462	$ 267,100
Net after taxes	126,113	91,892
Total income	126,210	91,961
Surplus after charges	93,304	60,036
12 mo. gross	3,626,100	2,969,668
Net after taxes	1,377,172	884,203
Total income	1,378,653	886,867
Surplus after charges	918,399	520,358

Pacific Gas & Electric Co.

For June—	1921.	Increase.
Gross	$ 3,227,064	$ 473,073
Surplus after interest and depreciation	452,246	218,634
Preferred dividend accrued	181,360	31,094
Common dividend accrued	141,684	.....
Balance	128,202	187,540
For 6 mo. ended June 30—		
Gross	$19,367,796	$2,993,060
Surplus after interest and depreciation	2,516,877	597,543
Preferred dividend accrued	1,061,192	163,477
Common dividend accrued	850,101	.....
Balance	605,584	434,066

American Light & Traction Co.

	1st quarter. 1921.	2d quarter. 1921.
Net earnings	$259,884	$966,617
Dividends	763,219	768,431
Deficit	503,334	*198,186

*Surplus.

Dividends.

	Term.	Rate.	Payable.
Cent. Ark. R. & L., pfd.	Q	1.75%	Sept. 1
Conn. Pr., pfd.	Q	$1.50	Sept. 1
Elec. Inv., pfd.	Q	1.75%	Aug. 22
Fed. Util., pfd.	Q	1.5%	Sept. 1
Phila. Elec.	Q	1.75%	Sept. 15
Phila. Elec., pfd.	Q	2%	Sept. 15
Rochester Gas & El.	Q	1.25%	Sept. 1
Standard Gas & El., pfd.	Q	2%	Sept. 15
Southwrn. Pr. & L., pfd.	Q	1.75%	Sept. 1

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Aug. 8.	Bid Aug. 15.
Adirondack Electric Power of Glenns Falls, common	6	9	9½
Adirondack Electric Power of Glenns Falls, preferred	6	69½	69
American Gas & Electric of New York, common	..	103	103
American Gas & Electric of New York, preferred	6	36½	37
American Light & Traction of New York, common	..	92	92½
American Light & Traction of New York, preferred	6	78	79
American Power & Light of New York, common	4	55	57
American Power & Light of New York, preferred	6	62½	63
American Public Utilities of Grand Rapids, common	..	6	7
American Public Utilities of Grand Rapids, preferred	7	17	17
American Telephone & Telegraph of New York	..	105	105
American Water Works & Elec. of New York, common	..	4	4
American Water Works & Elec. of New York, particip	7	8	8
American Water Works & Elec. of New York, 1st preferred	..	47½	48
Appalachian Power, common	..	4	5
Appalachian Power, preferred	7	29	28
Cities Service of New York, common	+extra	120	115
Cities Service of New York, preferred	6	46	45
Commonwealth Edison of Chicago	8	109	109
Comm. Power, Railway & Light of Jackson, common	..	10	10
Comm. Power, Railway & Light of Jackson, preferred	6	30	29½
Federal Light & Traction of New York, common	..	6½	7
Federal Light & Traction of New York, preferred	..	43	42½
Northern States Power of Chicago, common	..	37	36
Northern States Power of Chicago, preferred	ex.div.7	80	79
Pacific Gas & Electric of San Francisco, common	..	55	55
Public Service of Northern Illinois, Chicago, common	7	77	78
Public Service of Northern Illinois, Chicago, preferred	6	79	80
Standard Gas & Electric of Chicago, common	..	8	8
Standard Gas & Electric of Chicago, preferred	8	33½	34
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1
Tennessee Railway, Light & Power of Chattanooga, preferred	6	3½	4
Western Power of San Francisco, common	..	26	26
Western Union Telegraph of New York	..	87	81
Industrials—			
General Electric of Schenectady	8	117	114½
Westinghouse Electric & Mfg. of Pittsburgh, common	7	44	43½